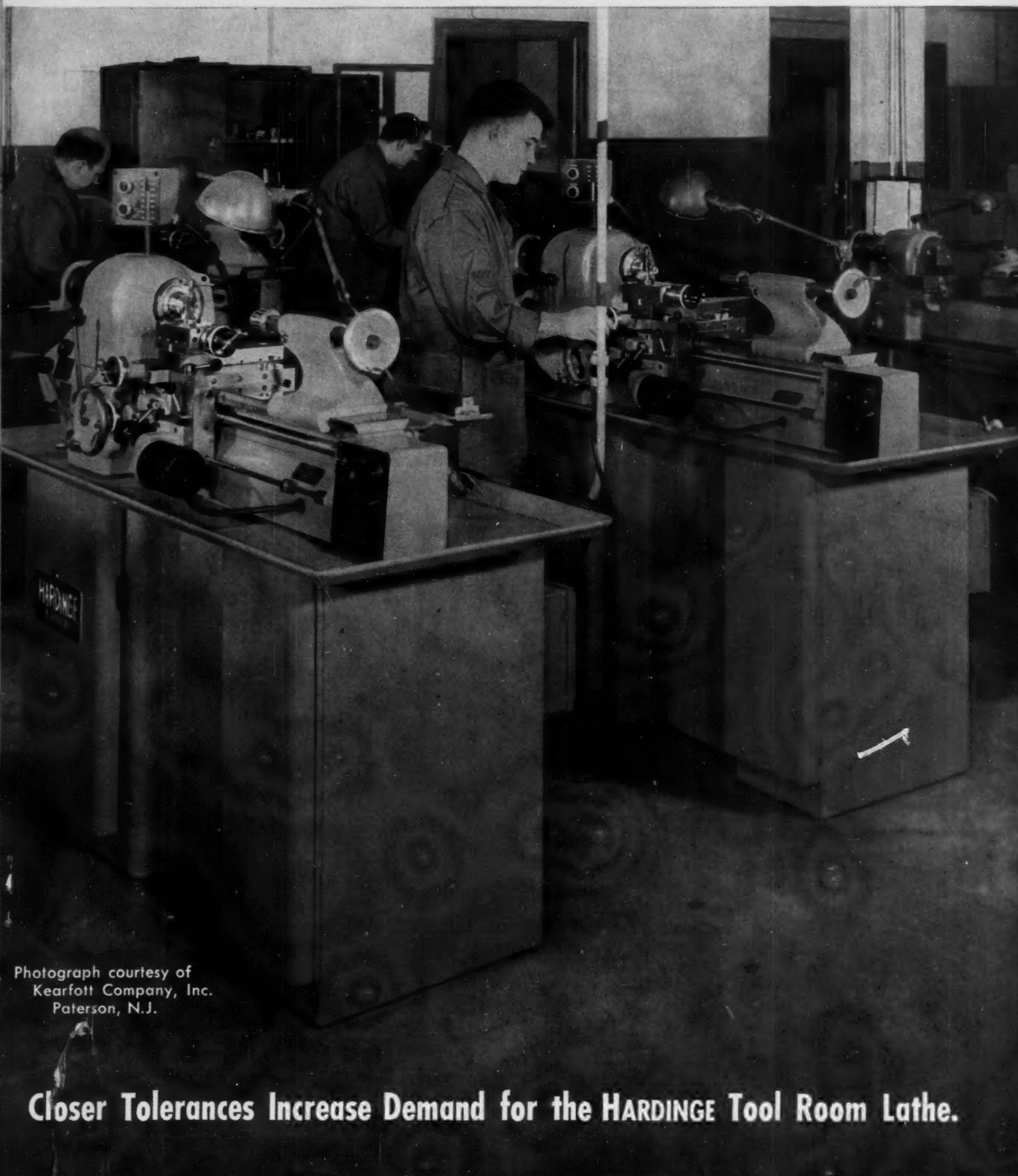
DECEMBER 1956—SIXTY-THIRD YEAR

MACHINERY



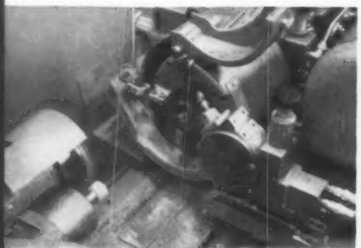
Photograph courtesy of
Kearfott Company, Inc.
Paterson, N.J.

Closer Tolerances Increase Demand for the HARDINGE Tool Room Lathe.

8 Ways to COMBINE

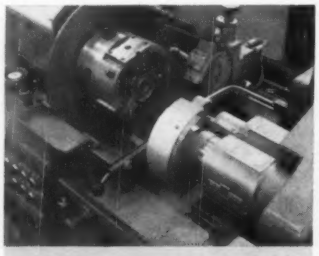
BORE and FACE GRINDING OPERATIONS

with Heald Multi-Spindle Internals



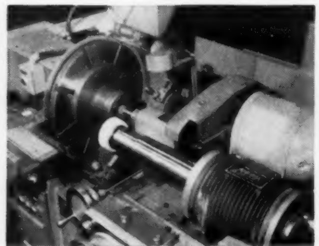
SIMULTANEOUS Bore and Face Grinding with SLIDE-BAR FACING

Bore grinding wheel reciprocates with table while facing wheel, mounted on anti-friction slide bars, is held forward against work under spring pressure. Face feeding stop controls depth of face grind.



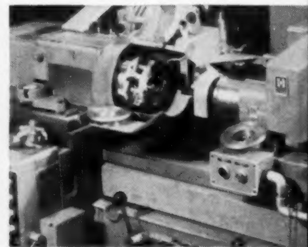
SEQUENTIAL Bore and Face Grinding with MANUAL FACING

Face is first plunged with manual facing attachment, while bore wheel enters bore without contacting work. Bore is then ground in Size-Matic cycle (facing wheel positioned to clear work on instroke).



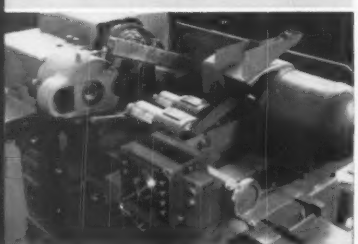
SEQUENTIAL Bore and Face Grinding with RETRACTABLE FACING HEAD

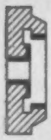
With motorized facing wheelhead in extended position, face is plunge ground with manual feed (bore wheel is clear of work). Workhead is indexed forward and bore ground in Size-Matic cycle.



SIMULTANEOUS Bore and Bottom Face Grinding with SINGLE WHEELHEAD

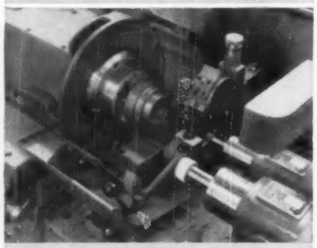
Combined bore and facing wheel feeds against work while workhead feed is operating, grinding face to finish size and plunging bore to semi-finish size. Wheel plunges bore to finish size while held clear of face.





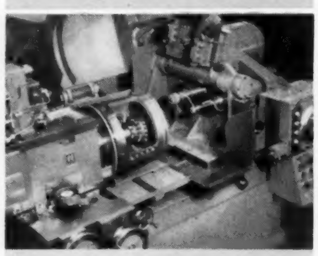
SEQUENTIAL Grinding of Two Bores and Bottom Face with SPACED WHEELHEADS

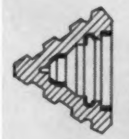
Small bore first ground to size (second wheel clears work), then workpiece is indexed forward in front of second wheel. Large bore is plunge ground and at same time wheel is fed forward to face grind bottom face.



SEQUENTIAL Bore and Bottom Face Grinding with SPACED WHEELHEADS

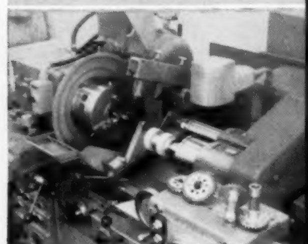
With workhead in rear position, bore is ground in Size-Matic cycle (facing wheel spaced to clear work). Work is then indexed forward and face is plunge ground to finish size, (bore wheel clears work).

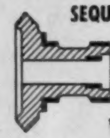




SEQUENTIAL Plunge Grinding of STRAIGHT AND CONTOUR BORES

Two wheelheads first plunge grind large straight bore and spherical ball race. Work is then indexed forward and small combined straight and taper bores are plunged with shaped wheel.





SEQUENTIAL Grinding of I.D., O.D. and FACE with Spaced Wheelheads

Bore is first ground to finish size with workhead in rear position (face and O.D. wheels clear of work). Workhead indexes forward and bottom face and two O.D.'s are plunge ground with double wheel.

WHENEVER two or more grinding operations can be done at a single chucking, you convert handling time into *grinding time.* What's more, you get a more positive relationship between ground surfaces than could be obtained by any other method. Here are eight different Heald setups for performing such combined operations quickly and economically. For complete information, send for a copy of new Bulletin No. 2–69–2.

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MACHINERY

VOLUME 63 DECEMBER, 1956 NUMBER 4

The Monthly Magazine of Engineering and Production in the Manufacture of Metal Products

SHOP PRACTICE

MACHINE AND TOOL DESIGN

MANAGEMENT PROBLEMS AND EVENTS

DEPARTMENTS

rolling taper pipe threads

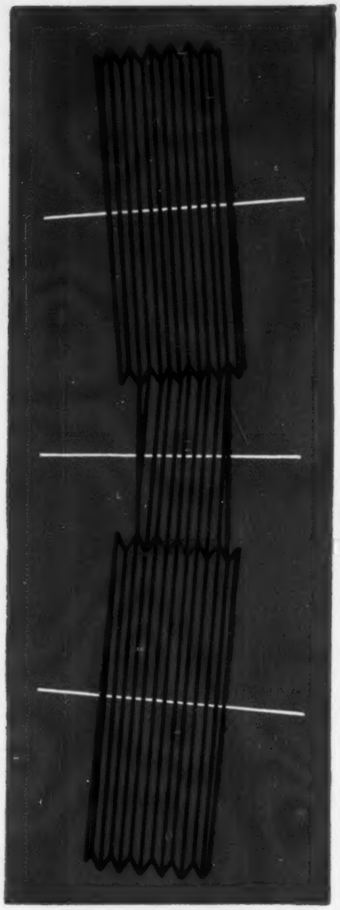
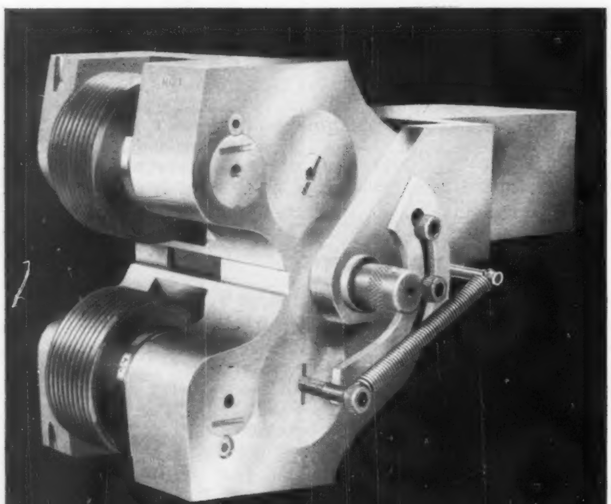


Figure 1

with the LANROLL thread rolling attachment



Thread-roll wear is minimized by the recently developed LANDIS Method (Patents Pending) for precision rolling of taper pipe threads (including dry-seal).

To produce the taper, the rolls of the LANROLL Attachment are supported on carbide shafts inclined to the required thread taper. This design enables the use of parallel rolls (see Figure 1) which reduces slippage between the workpiece and the rolls. With reduced slippage, roll life is materially increased. In addition, attachment stabilization (limited sidewise movement)

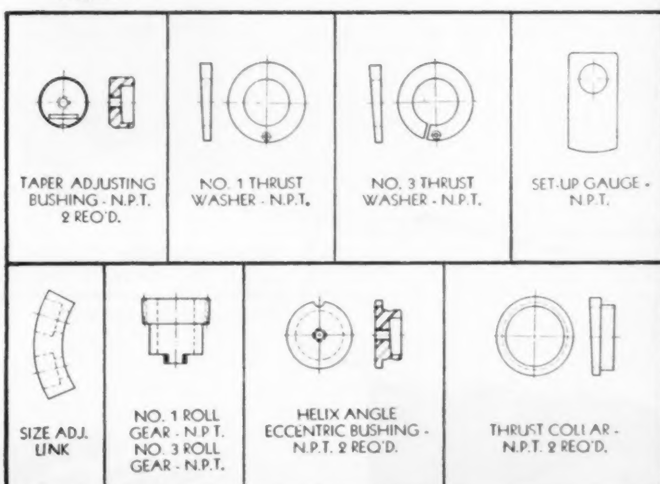
is greatly improved to permit rolling directly to a shoulder with safety.

Of an adjustable design, the LANROLL Attachments provide wide range coverage while retaining the rigidity of a non-adjustable tool. Either straight or tapered threads can now be produced with the same attachment through the use of proper rolls and auxiliary equipment. Five sizes with varying dimensions are available for use on the many sizes and makes of bar automatics, and will produce coarse pitch threads to Class 4 tolerances on all diameters from #5 to $1\frac{3}{4}''$ for straight threads, and precision pipe threads from $\frac{1}{16}''$ to $1\frac{1}{4}''$ in diameter.

In addition to proper rolls, the auxiliary equipment necessary to change from straight to taper threading is negligible, as illustrated in Figure 2. When changing from one pipe size to another within the range of the attachment, the size adjusting link, set-up gage and rolls are the only equipment changes required. With this design tooling flexibility is obtained with minimum cost. These changes assure operation of the attachment for every size within its range as though it were exclusively engineered for the particular work being threaded. Also, the same simplified and precise methods of set-up and roll timing used for straight threading are used for taper threading.

For additional information ask for Bulletin G-96 and specify straight or taper work.

Figure 2



longer roll life with LANDIS parallel-roll method

Note that in producing a taper thread one end of each roll is required to thread a larger diameter than its opposite end. This results in unequal circumferential travel by the respective roll ends during each revolution. However, in traveling these unequal distances both ends of the roll make a revolution in the same interval of time. Therefore, the end of each roll on a large thread diameter must travel at a higher peripheral velocity than its opposite end on the small diameter. These necessary differentials in peripheral velocities for the roll ends can only exist by slippage between the roll and the workpiece. This slippage becomes more acute on the larger diameters as the differentials become greater or where tapered rolls on parallel axis are used. **By presenting parallel rolls to the workpiece, the LANDIS Method (see Figure 1) reduces the differentials in peripheral velocities and its accompanying roll slippage.** Roll life, of course, is greatly benefited by any reduction of slippage.

In developing a roll diameter for a particular thread, the pitch diameter of the workpiece is used as a basis. If the workpiece is straight, the relationship of the roll diameter to the workpiece diameter remains constant. For taper threads the roll diameter is normally developed from the pitch diameter at the mid-point of the effective thread. Thus, the diameter of the roll thread in respect to the diameter of the workpiece thread will only agree at one point. On either side of this point the roll diameter will be either too large or too small. This disagreement in the roll and workpiece diameter relationship results in attachment instability (sidewise movement). Maximum instability occurs if taper threads are produced with tapered rolls on parallel axis as the relationship of the roll and workpiece diameters vary in direct opposition. This instability becomes more apparent on the larger diameters as wider thread rolls having a greater disagreement are required to produce [illegible] thread lengths. **By use of parallel rolls on inclined axis (see Figure 1) the LANDIS Method reduces disagreement in the relationship of the roll and and workpiece diameter by one half.** In this case, both ends of each roll have a pitch diameter equal to the P.D. from which the roll was developed. Improved attachment stabilization results and rolling to a shoulder can be accomplished with safety.

LANDIS *Machine* COMPANY WAYNESBORO PENNSYLVANIA

For more information fill in page number on Inquiry Card, on page 225

THIS RED LINE

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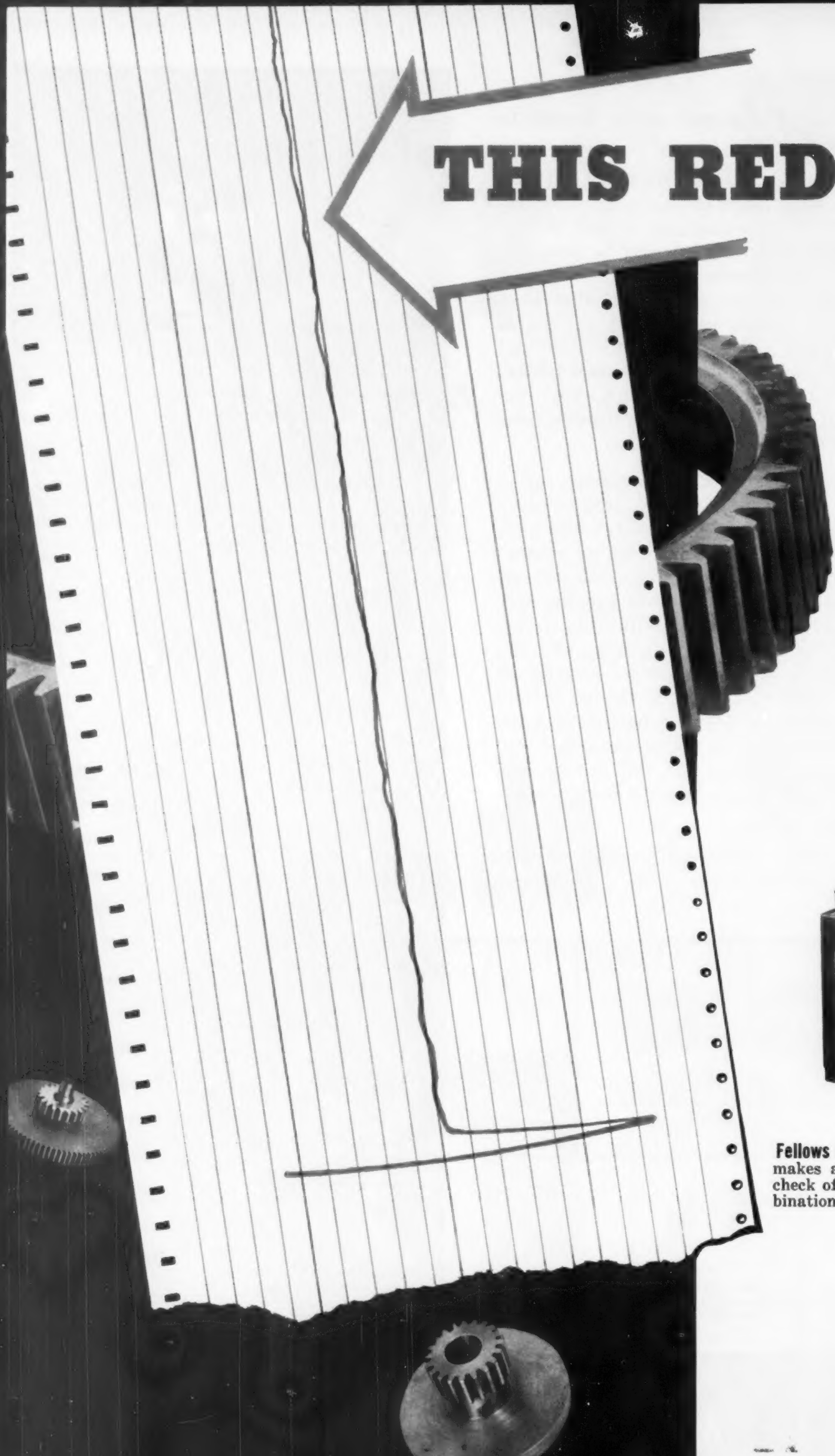

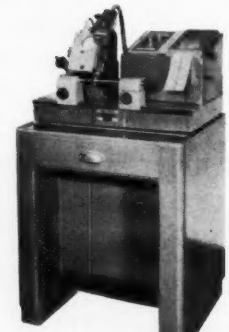

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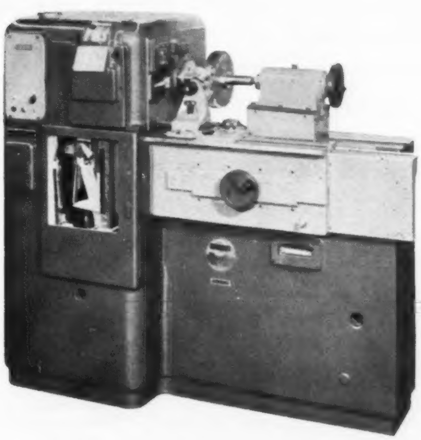
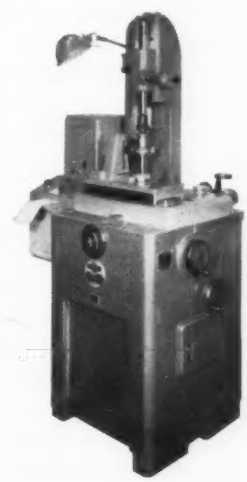


Fellows Lead Measuring Instrument: measures and electrically records the accuracy of helical and other surfaces; checks crown and taper. 12" and 24" P.D. capacities.

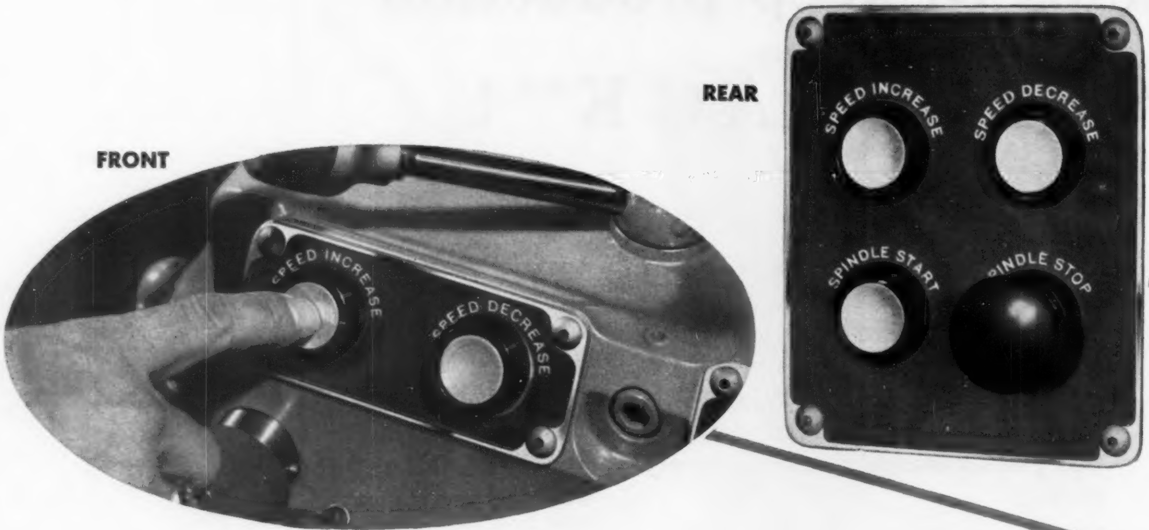


Fellows Involute Measuring Instrument: rapidly and easily checks involute profiles of external and internal spur and helical gears and records results. 12" and 24" P.D. capacities.

Fellows *Gear Production Equipment*

For more information fill in page number on Inquiry Card, on page 225

Cincinnati Gives You



In your home, your workshop, practically everywhere you look push buttons are the ultimate in convenience. Now they perform an important chore in machine tool operation; they select spindle speeds on CINCINNATI® Dial Type Milling Machines at the front and rear operations positions. But convenience is not the only advantage. They also save time and reduce costs. How? In operating a toolroom miller, spindle speeds should be changed as often as the job requires. On CINCINNATI Dial Types, push buttons do it in a few seconds throughout the entire range of 18 to 1800 rpm for the No. 2 Machines, and 16 to 1600 rpm for the Nos. 3 and 4 Machines. And because it's quick and easy, the optimum cutting speed can always be used; cutting action is more efficient and there's less possibility of wrecking the cutter. There are many other CINCINNATI Dial Type advantages:

Power dual selection of feeds, 3/8" to 90" per min.

Independent, directional controls, with name knobs

Automatic backlash eliminator

Dynapoise chatter-damping overarm

Automatic table feed cycles available for plain and vertical machines

Want more information? Look in Sweet's Machine Tool File for brief specifications; complete data in catalog No. M-1915.

THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO

DIAL TYPE LINE		table traverse	main drive	automatic table cycles available
No. 2	Plain Universal Vertical	28"	10 hp	yes no yes
No. 3	Plain Universal Vertical	34"	15 hp	yes no yes
No. 4	Plain Universal Vertical	42"	20 hp	yes no yes

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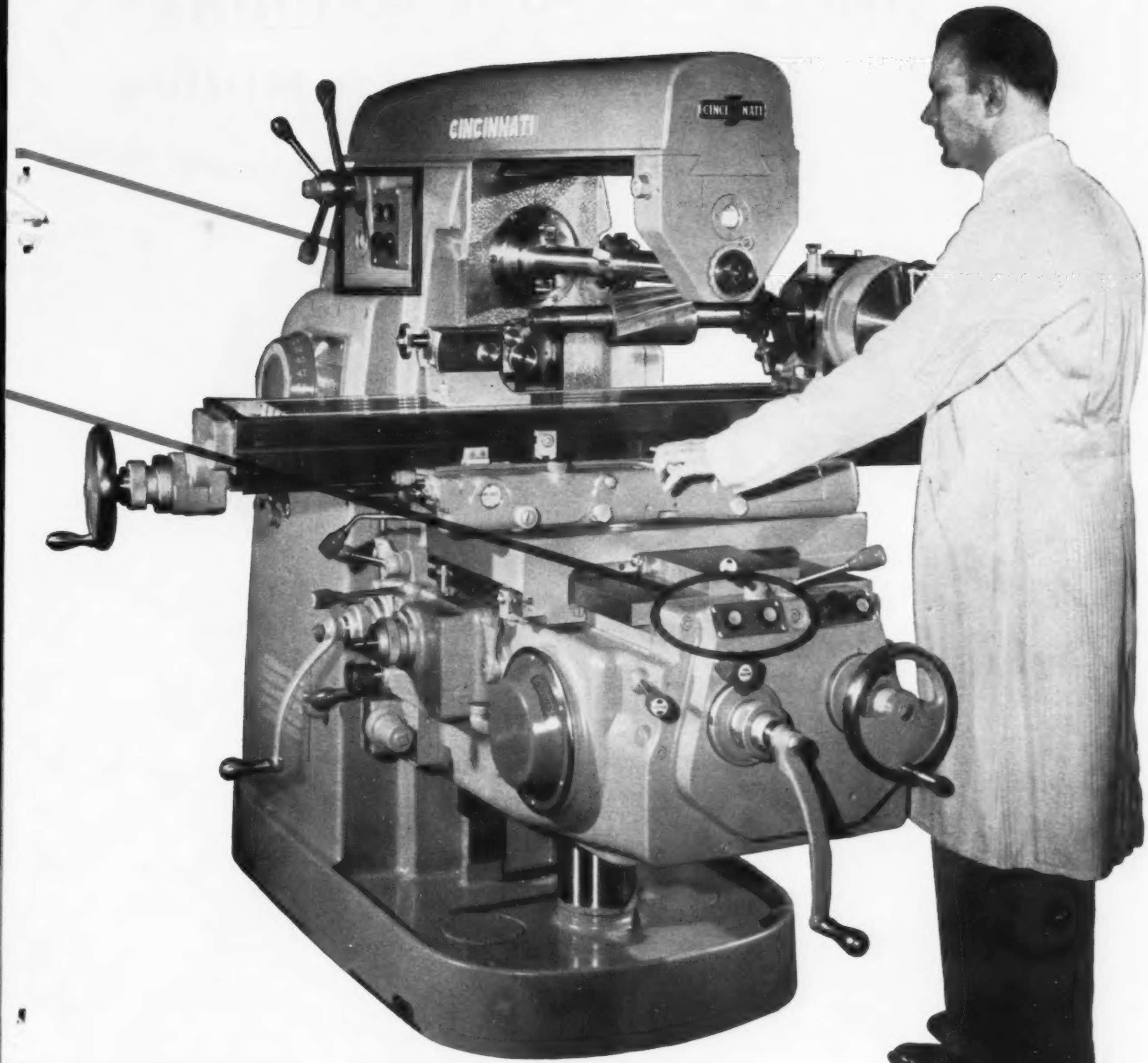
Push Button Convenience for Spindle Speed Selection



CINCINNATI NO. 2 UNIVERSAL DIAL TYPE MILLING MACHINE easily takes a heavy helical milling cut.

HARDENING MACHINES • OPTICAL PROJECTION PROFILE GRINDERS • CUTTING FLUID • GRINDING WHEELS

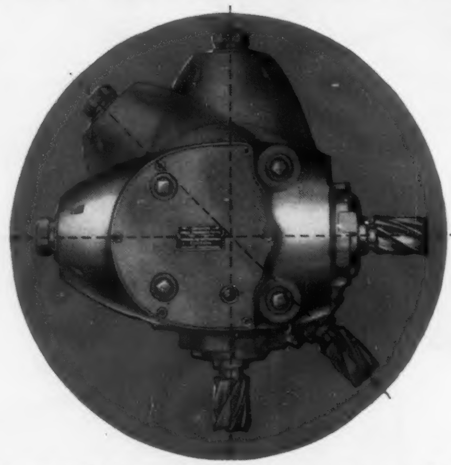
VAN NORMAN Ram Type Millers

DO THE WORK OF

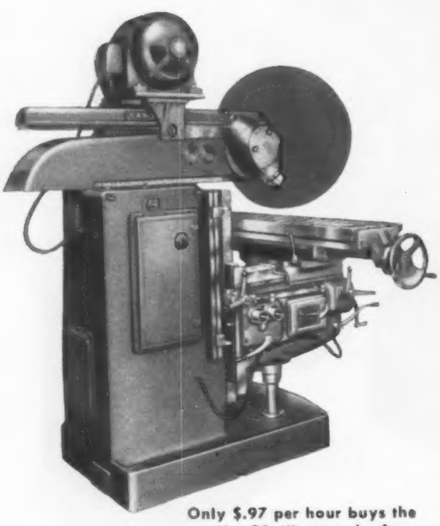
TWO SINGLE PURPOSE MACHINES

...PLUS *Angular* Milling

without Attachments



The adjustable cutterhead gives you two millers in one. Enables you to do horizontal, angular or vertical milling. It eliminates idle machine time . . . helps you increase production . . . cut costs.



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No matter what your milling requirement, you simply can't beat Van Norman Ram Type Millers for getting out more pieces per worker-hour, per shift.

So why invest in two single purpose machines and attachments when *One* Van Norman Miller does the work of two, plus angular milling without attachments?

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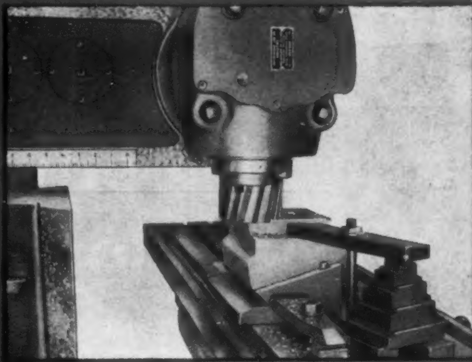
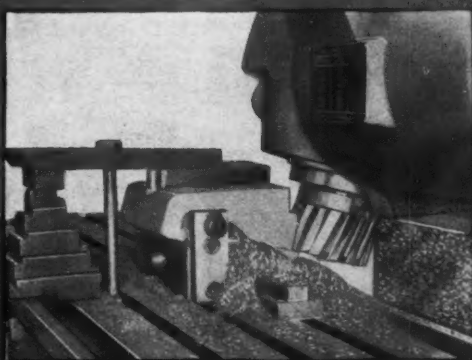
VAN NORMAN MACHINE

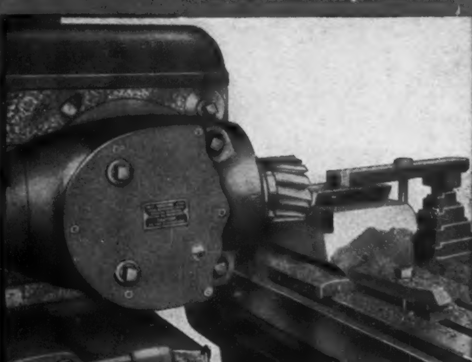
MANUFACTURERS OF — Ram and Column Type Milling Machines, Cylindrical Grinders, Spline and Gear Grinders, Oscillating Radius Grinders, Special Production Grinders, Centerless Grinders.



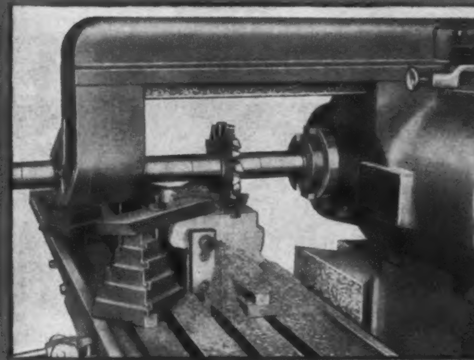
1. With the cutterhead locked in the vertical position, a milling operation is performed on the workpiece.



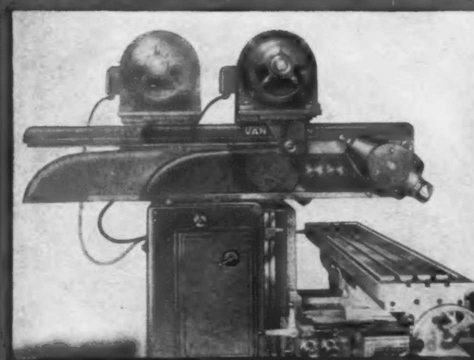
2. An angular milling operation being performed on the same workpiece . . . angular range of cutterhead is 0 degrees to 90 degrees. Note the workpiece is still in the same position.



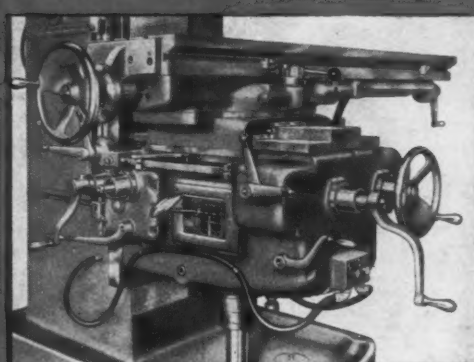
3. With the workpiece in the same set-up and the cutterhead in horizontal position, two square faces are milled in the work. Note the workpiece set-up has not been changed.



4. With the cutterhead in horizontal position, a slot is milled in the same workpiece. Overarm and outer brace provide maximum rigidity. Note work position has not been changed.



5. Heavy adjustable ram increases work range . . . permits maximum cuts to the full capacity of the motor. Ram movement 29". Ram scale makes positioning easy.



6. Front and rear directional controls simplify operation. This dual control saves time and reduces worker fatigue. Exclusive Van Norman single lever feed selector permits quick, easy selection of feeds.

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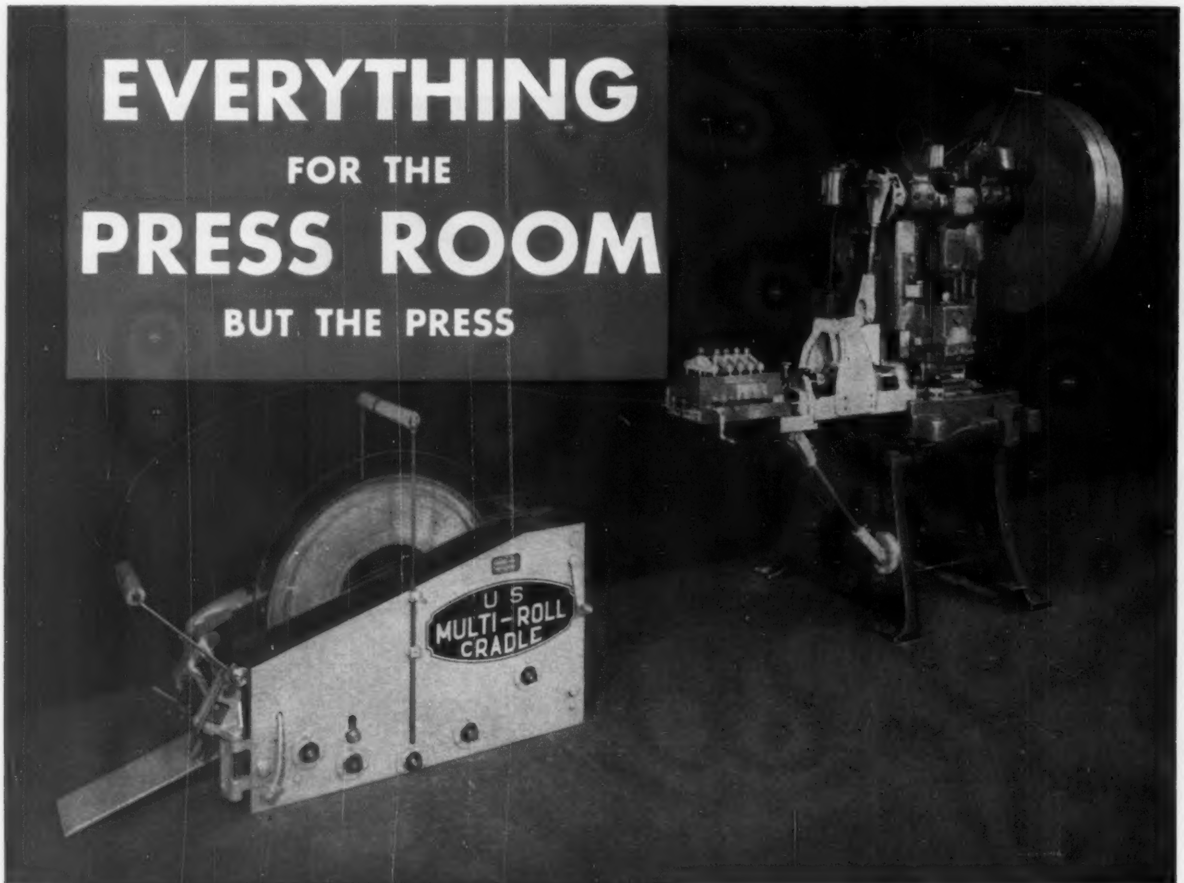
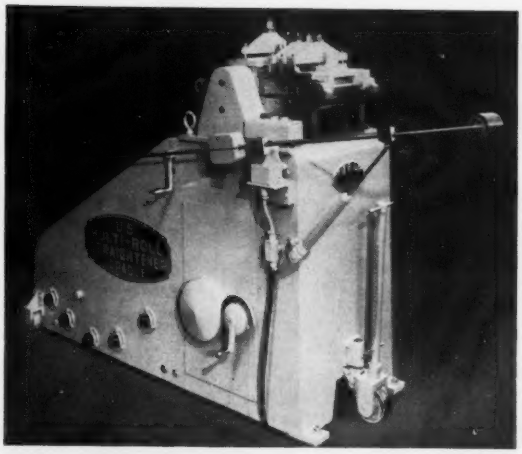
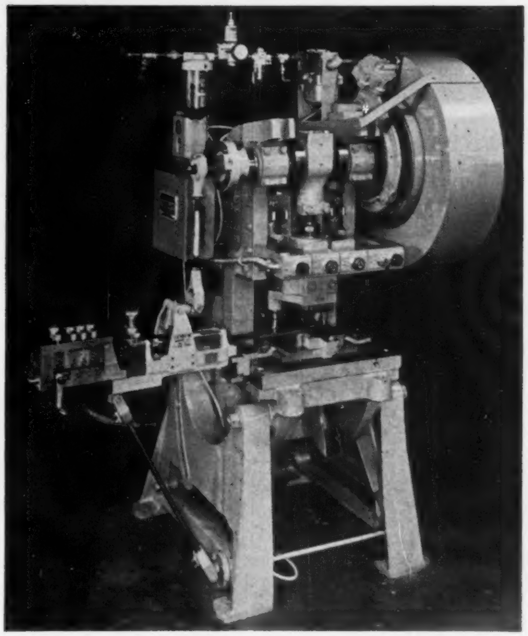

EVERYTHING
FOR THE
PRESS ROOM
BUT THE PRESS
U S
MULTI-ROLL
CRADLE





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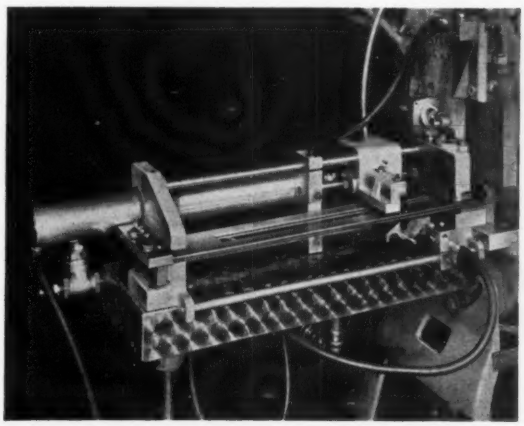


Also U. S. MULTI-SLIDES

For the automatic high-speed production of precision formed stampings from coil stock, your attention is called to the U. S. Multi-Slide Machine as described and illustrated in Bulletin No. 15-M.

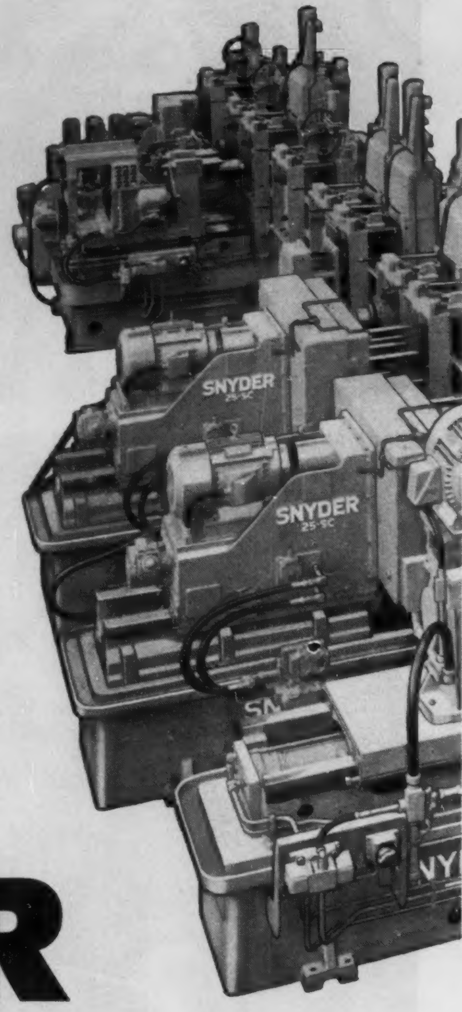
U. S. MULTI-MILLERS

Production horizontal type Milling Machines for the performance of a wide range of milling operations on small and medium sized parts described in Bulletin No. 25-M.

UNIQUE FEATURES IN SNYDER 9-SEGMENT, 24-STATION, IN-LINE AUTOMATED TRANSFER MACHINE

MACHINE for processing converter housings; independent control panels permit individual segment operation (co-ordinated with master panel); electric circuits can be individually checked by Circuit-Sleuth Panel; at Station 4, workpiece is re-oriented 90°; at Station 21, two dowel holes and one transmission hole are precision bored to .001 in size; at Station 22 these holes are automatically precision air gaged.

Workpiece reaches machine finish ground on both faces; machine performs 59 operations, delivers workpiece completed and automatically inspected. Production, 128 pieces an hour at 100% efficiency.



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TOOL & ENGINEERING COMPANY

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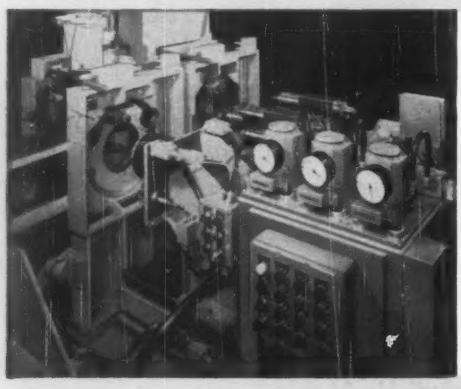
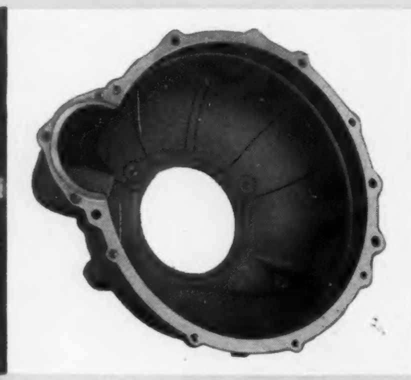
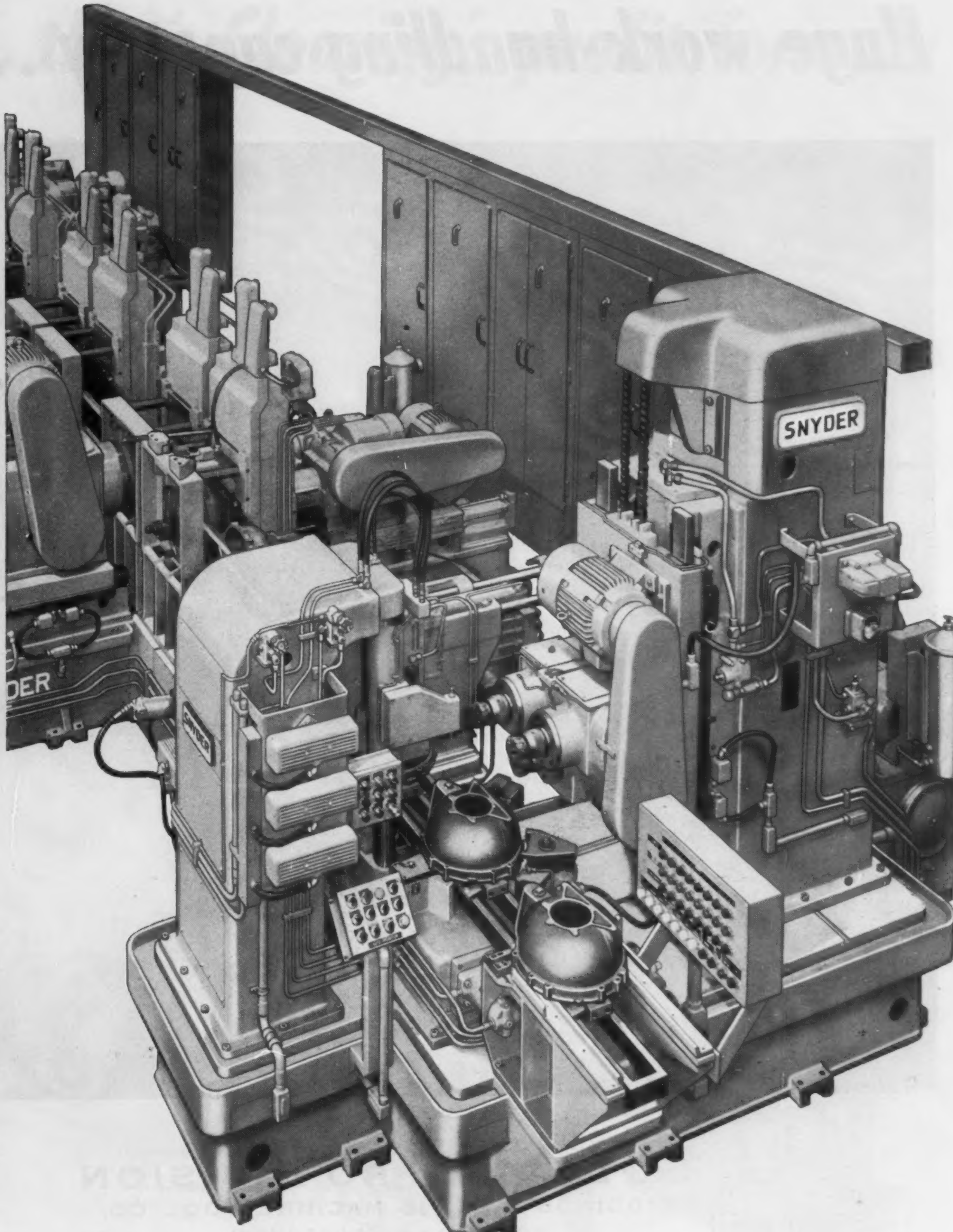




Boring and air gaging stations.


SNYDER
SNYDER

. that's Clearing's profit formula

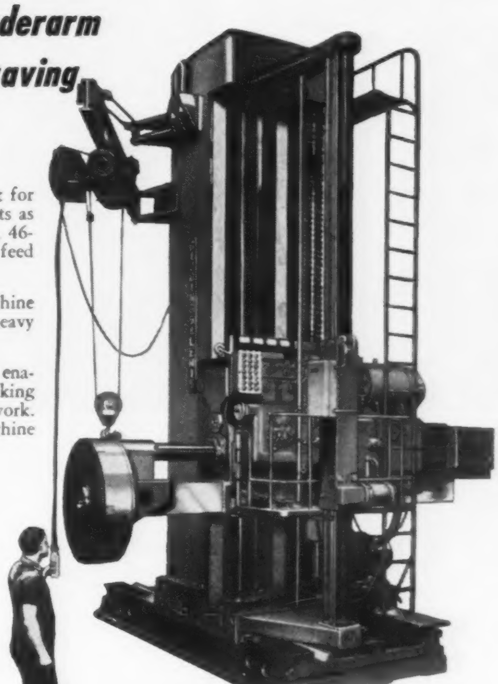
80-ton hydraulic press weldment machined on Giddings & Lewis Model 570-FUAR Horizontal Boring, Drilling and Milling Machine

A 166,000-pound giant, this Giddings & Lewis Model 570-FUAR Horizontal boring, drilling and milling machine with 7″ diameter spindle underarm support and 75-hp spindle drive, is the *most powerful . . . most versatile* machine ever designed. It has the ability to maintain exact tolerances in machining huge castings or weldments at extended work ranges. Clearing Machine Corporation, division of U. S. Industries, Inc., Chicago, uses Model 570-FUAR to precision machine many of the weldments used in their power presses. In illustration at the left, Clearing is boring 18″ diameter bearing holes with a feed rate of .025″ per revolution at 12 rpm . . . mill-face the pads . . . and cut the tee slots on an 80-ton, 307″ long x 114″ wide hydraulic press bed weldment.

The machine underarm support assures maximum precision under heaviest cuts, even when performed at considerable distances from the headstock. Extended travel of both headstock and column provides additional machining versatility. For more information on G&L's 50 Series machines, see your nearest G&L representative, or write to factory.

All-new Model 570-FUAR with 7″ diameter spindle and underarm support . . . featuring time-saving optional equipment

- 7-inch diameter spindle with underarm support for mounting such productive machining attachments as shaper-slotter head, angular milling attachment, 46-inch face plate drive and 48-inch continuous feed facing and boring head.
- Power hoist, mounted integrally with the machine column, facilitates handling and setting up of heavy accessories.
- Built-in elevator on machine's 21-foot column enables the operator to select the most ideal working position in relation to the headstock and work. Elevator operates independently of the machine headstock.



Literature Available:

For complete specifications on G&L 50 Series (floor-type) horizontal boring, drilling and milling machines, ask for Catalog No. 50-F.

presses...

...they require a minimum of maintenance"

In-line operation of four Niagara Series SC-2 Presses, engaged in progressive production of automotive side moldings from .025" #430 stainless steel.

Press operator shows a blank and formed molding which will grace one of the "Big Three" cars.

Producing up to 1,750,000 automotive moldings per month, these four Niagara Double Crank Straight Side Presses do the work of eight for a large Midwestern metal stamping firm. Their long beds enable the outfitting of each press with two sets of dies for two separate operations.

"We believe in standardizing. That is why we concentrate on Niagara Presses. They require a minimum of maintenance. When jobs come in, we are sure we can get them out. They are a volume machine," says the vice president and plant superintendent.

. . . and with good reasons, this famed line of Niagara presses requires a minimum of maintenance:

- *Rugged, integral, all-welded steel frames of exclusive triple box section design properly resist deflection to assure greater accuracy and longer die life.*
- *Laminated non-metallic ways of box type welded steel slides are a positive safeguard against scoring and assure trouble-free service.*
- *Low inertia pneumatic friction clutch reduces heat and wear. Only the shaft and driving plate are started and stopped at each cycle. Most of the clutch weight continues to rotate with the flywheel.*
- *Outboard mounting of clutch makes it accessible for easy maintenance . . . without disturbing any drive or crown parts.*
- *No adjustment for wear of clutch plate is necessary. It is self-compensating.*
- *Clutch linings are cycle-welded to plate, without rivets, increasing effective life.*
- *Brake shoes are full floating and self-aligning . . . cannot cock, bind or wear unevenly.*
- *Steel gears run in totally enclosed oil baths. Centralized pressure lubrication sends vital oil to journals, ways and wherever necessary for long efficient, service life.*

Like this well known metal fabricator, it will be profitable for you, also, to consider standardizing on Niagara presses. First of all, Niagara has the most to offer . . . straight side double crank, single crank and eccentric geared, open back inclinables and dozens of others. Secondly, in the words of the same company's purchasing agent: "The prices on Niagara Presses are right . . . and they do the job."

Built in 50 through 400-ton capacities, Niagara Double Crank Straight Side Presses are readily equipped with automatic feeds, variable speed drives, iron hands and other automatic materials handling devices so popular with the automotive and appliance industries. Post yourself on this important line by requesting Bulletin 64.

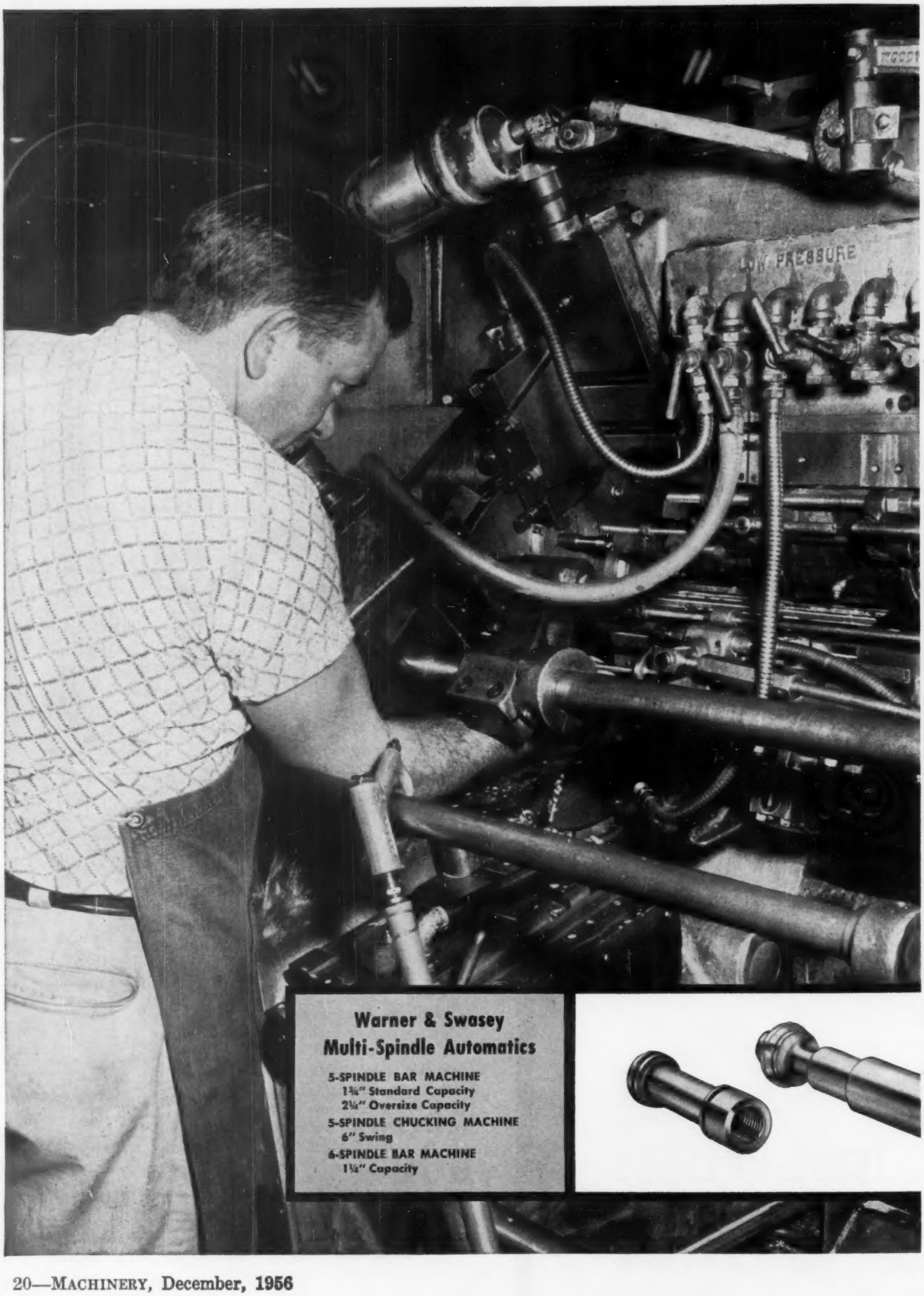
SIDE PRESSES

NIAGARA MACHINE & TOOL WORKS • BUFFALO 11, N. Y.

DISTRICT OFFICES:

Buffalo • Cleveland • Detroit • Indianapolis • New York • Philadelphia

Distributors in principal U. S. cities and major foreign countries


LOW PRESSURE
Warner & Swasey
Multi-Spindle Automatics
5-SPINDLE BAR MACHINE
1¾" Standard Capacity
2¼" Oversize Capacity
5-SPINDLE CHUCKING MACHINE
6" Swing
6-SPINDLE BAR MACHINE
1¼" Capacity

WARNER & SWASEY AUTOMATIC CUTS SMALL LOT COSTS...

solves inventory problem for Cleco Division, Reed Roller Bit Company

Cleco Division, Houston, Texas, manufactures a wide variety of air tools. About 6000 different component parts must be machined each year—and, in order to keep reasonable inventory, in relatively small lots ranging from 100 to 1000 pieces.

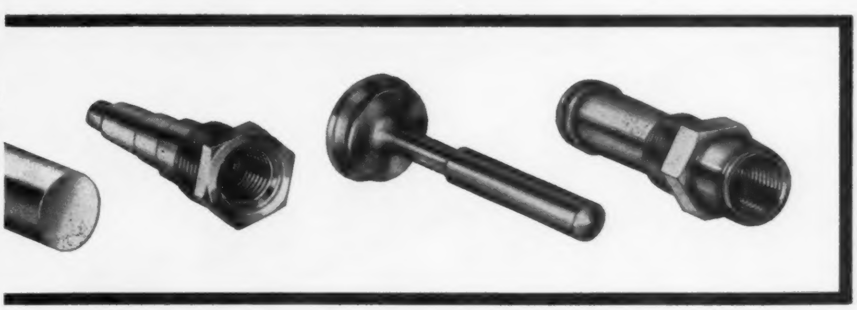
While production on small hand-operated turret lathes kept inventory in line, it resulted in too high a cost per piece. On the other hand, economical production on conventional automatics required larger lot sizes and higher inventories.

In 1948, Cleco installed a Warner & Swasey 5-Spindle Automatic to solve both these problems. Its quick setup permits machining small lots at automatic rates—reducing cost per piece, and inventory at the same time.

This automatic has been operated on a two-shift basis—the equivalent of 16 years of one-shift production—with an exceptionally low record of downtime. Only $144 has been spent for repair parts. And despite this usage, cross slide form cuts to within .002" are easily held.

Foreman O. R. Palmer says: "We handle as much of our short run work as possible on the Warner & Swasey. Only when there's more such work scheduled than the machine can accommodate do we route the surplus to other automatics." Cleco operators like the automatic's quick-set quadrants which eliminate cam changing for feed strokes, its micrometer-dial cross slide adjustment, and general ease of operation.

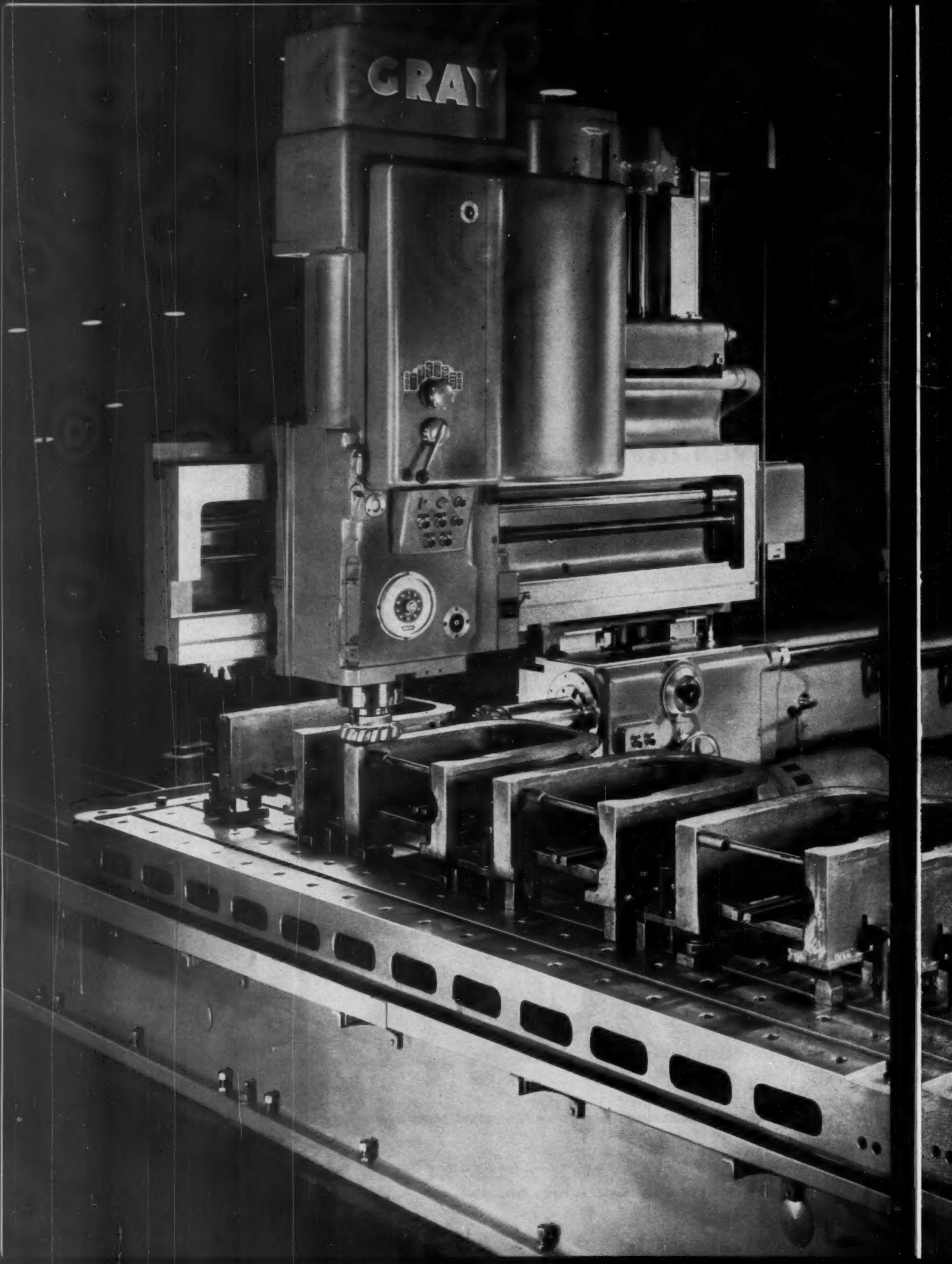
If you'd like to reduce your machining costs on small and medium lot production—as well as long runs—call in our Field Representative. He'll be able to tell you whether your work can be done more profitably on a Warner & Swasey Multi-Spindle Automatic.



WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880

YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS... WITH A WARNER & SWASEY

For more information fill in page number on Inquiry Card, on page 225


GRAY

If you're tired of seeing small jobs on your large expensive millers . . .

If you're tired of extra set-ups because your miller has only a single head . . .

If you're tired of whittling away at rugged jobs with low power heads . . .

If you're tired of complicated controls that make your operator a mountain goat . . .

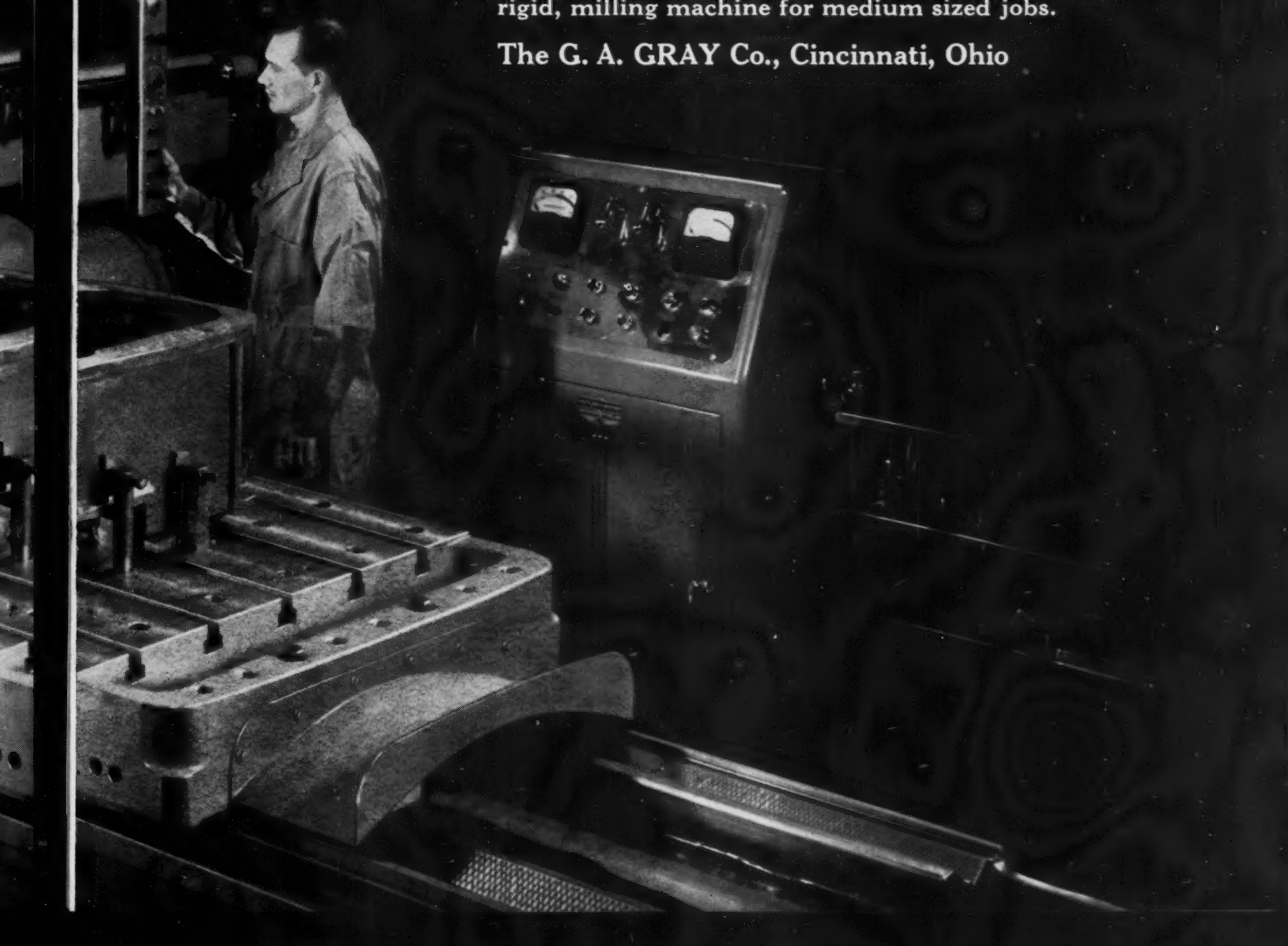
this new

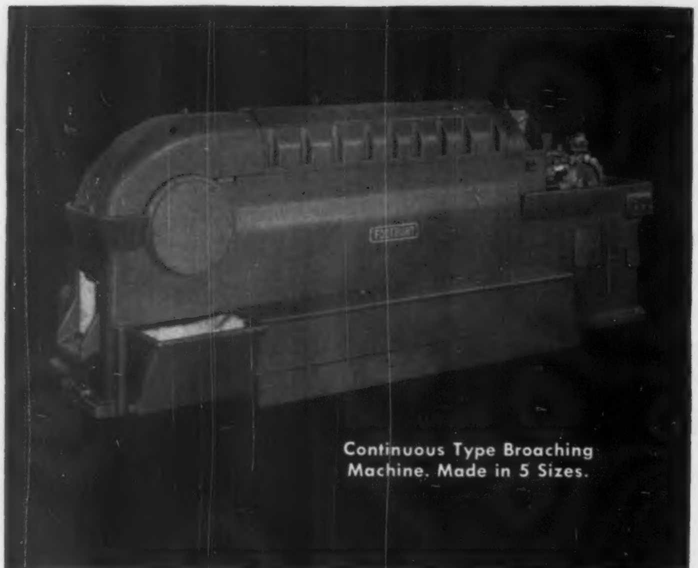
GRAY HANDYMILL

is for you

Built in a wide range of high horsepower sizes, with great variety in head combinations, simplified pendant control, it fills a long standing need for a powerful, rigid, milling machine for medium sized jobs.

The G. A. GRAY Co., Cincinnati, Ohio





Continuous Type Broaching Machine. Made in 5 Sizes.

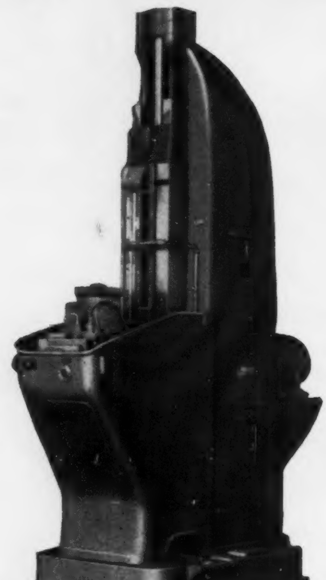
Duplex Surface Broaching Machine. Made in 5, 10, 15 and 25 Ton Sizes.

FOOTBURT

a faster *More Economical* machine operation

■ Footburt Surface Broaching may be the answer to your problem of faster machining. Many jobs that were slow and expensive when handled by conventional machining methods are now being produced by Surface Broaching. Production in most cases is as fast as the speed at which parts can be loaded. Yet cutting speeds are so low that the cost of tool maintenance shows great savings. Exceptional finish can be maintained. We will gladly discuss your machining problems with you.

THE FOOTE-BURT COMPANY
Cleveland 8, Ohio • Detroit Office: General Motors Building



Single Slide Surface Broaching Machine. Made in 5, 10, 15 and 25 Ton Sizes.

FOOTBURT

PIONEERS IN SURFACE BROACHING

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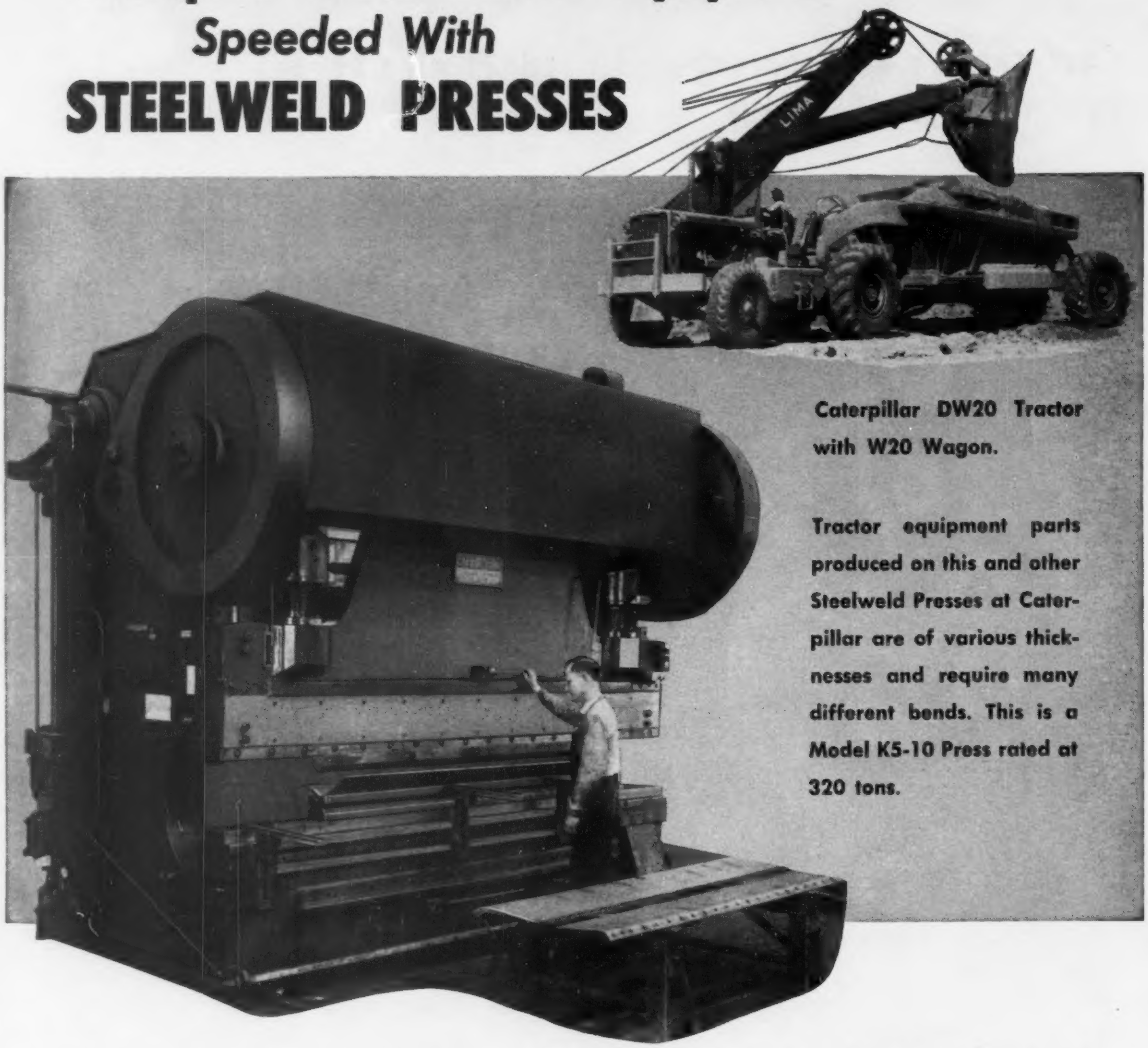
Caterpillar-Built Tractor Equipment
Speeded With
STEELWELD PRESSES



Caterpillar DW20 Tractor with W20 Wagon.

Tractor equipment parts produced on this and other Steelweld Presses at Caterpillar are of various thicknesses and require many different bends. This is a Model K5-10 Press rated at 320 tons.

THE ease and speed with which dies can be changed on Steelweld Presses and necessary adjustments made have proven a big asset in obtaining high production of a great variety of steel parts for scrapers, rippers, bulldozer blades and wagons at the Joliet Plant of Caterpillar Tractor Co.

Because of simplicity of Steelweld operation, the parts can be turned out quickly and accurately. The heavy quality construction, including solid one-piece frame, finest electrical equipment and automatic oilers for lubrication of all bearings, keep Steelweld Press maintenance extremely low and assure uninterrupted production.

GET THESE BOOKS!

Catalogs No. 1010 (Presses) and No. 1011 (Shears) give construction and engineering details. Profusely illustrated.

THE CLEVELAND CRANE & ENGINEERING CO.

5449 East 281 Street, Wickliffe, Ohio

STEELWELD
PRESSES and SHEARS

Want to make every day Christmas?

It's easy! Switch to CINCINNATI (PD)° WHEELS. For *now* CINCINNATI Grinding Wheels offer POSITIVE DUPLICATION—a remarkable achievement in precision manufacturing and quality control that *can save you money* . . . and *increase your production.*

You'll say there *is* a Santa Claus after all when you learn that through the CINCINNATI (PD) Manufacturing Process you are assured Positive Duplication of the original wheel every time you reorder. "On grade" with a CINCINNATI (PD) WHEEL means all future (PD) WHEELS will act and grind exactly alike.

Yet CINCINNATI (PD) WHEELS *are priced no higher than ordinary wheels.*

So, to make every day Christmas, just contact your CINCINNATI Grinding Wheel distributor. Or, contact us direct and we'll send one of our representatives—men who know grinding and grinding machines as well as grinding wheels. Write, wire or telephone Sales Manager, Cincinnati Milling Products Division, Cincinnati 9, Ohio.

Remember—*only* CINCINNATI Grinding Wheels give you . . .

(PD) POSITIVE DUPLICATION

A PRODUCTION-PROVED PRODUCT OF THE CINCINNATI MILLING MACHINE CO.

CINCINNATI°
Grinding Wheels

° Trade Mark Reg. U. S. Pat. Off.

For more information fill in page number on Inquiry Card, on page 225

are you running hard...

Conservative studies of growth potentials and long range trends, by both industry and government, show clearly that markets are already outrunning the labor supply for industrial production. The pace will get increasingly faster as our growing population demands more goods and services.

Those companies which stay in the race will do so by stepping up their productivity per man hour, and planning their capital expenditures accordingly. They will not stumble over the problem of machines displacing men, because they know there will not be enough labor to fill all the jobs created in the next ten years.

Avey production machines have already increased productivity per man hour, per square foot of plant space, and per dollar of invested capital in many plants. Their fast rate of return makes it profitable and pleasant to stay in the running.

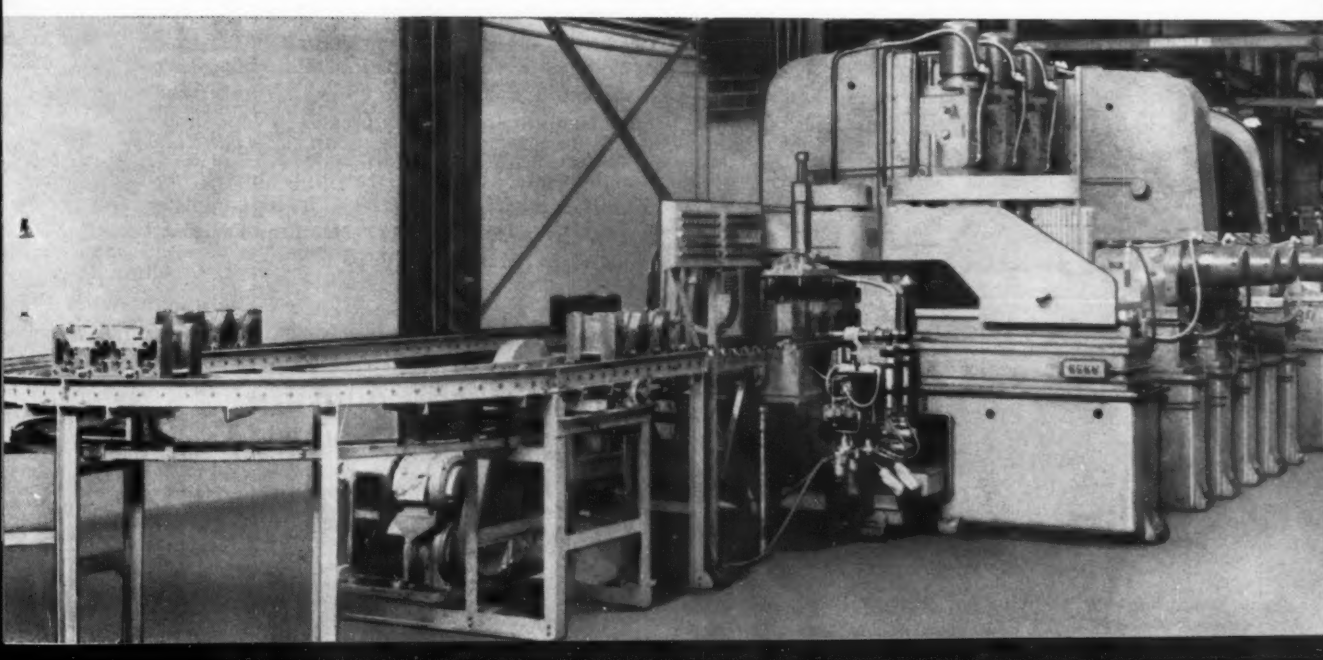
production data: This machine automatically rough and finish mills, drills, countersinks, and taps 260 hydraulic pump covers per hour. Operations include automatic gauging, probing, and insertion of bronze bushing in bore.

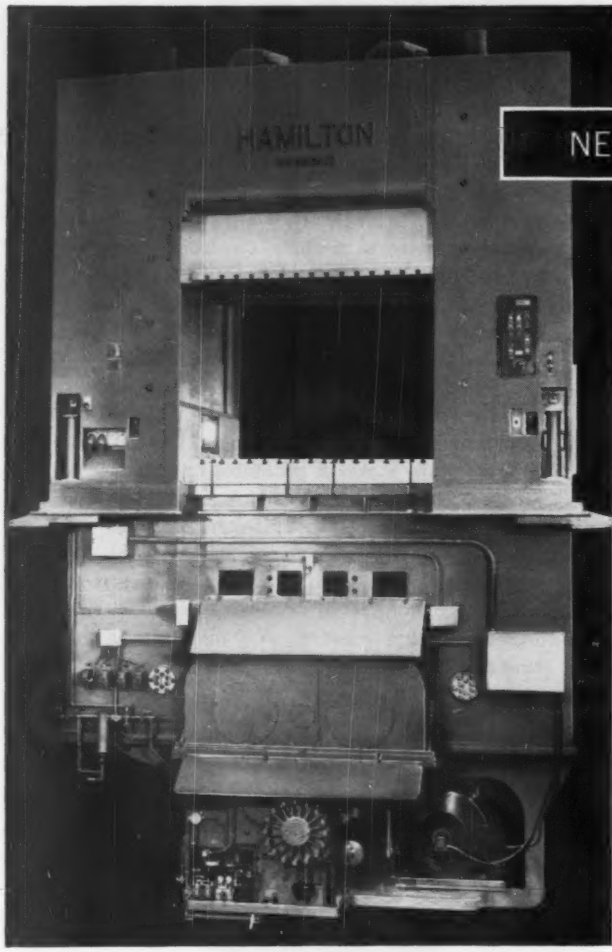
THE AVEY DRILLING MACHINE CO., CINCINNATI 1, OHIO

drilling, tapping, production machines

and losing ground?

Avey





NEWS FROM HAMILTON!

New 500-4000 ton underdrive draw press "package"...

for fast easy installation...
simplified maintenance...
smooth, safe drawing...
more productive strokes per minute

Thirty years the leader in the mechanical press field, Hamilton now gives you this latest product of dynamic press know-how. An all-new line of 500 to 4000 ton mechanical draw presses engineered for fast, safe drawing operation . . . with each press a "package unit" for quick installation, easy maintenance.

- *Package design* keeps all piping and wiring within the rugged, welded steel press structure. Installation is quick and easy.
- *Hamilton's Exclusive Double-Lube system* provides both pressure and gravity flow lubrication to all bearings.
- *Operating mechanism in the press bed* simplifies inspection and maintenance during operations.
- *Variable cycle sequences* insure more productive strokes per minute.
- *Swivel arrangement of counterbalance cylinders* insures proper alignment when gibs are adjusted.

You'll speed your production while you slash installation and operating costs . . . with these new Hamilton underdrive presses in your shop. They're designed and built to handle your toughest jobs better, faster—with far less down-time. Get the full story today! Write for complete specifications to Dept. 9677, Hamilton Division, BLH Corp., Hamilton, Ohio.

BALDWIN BLH LIMA-HAMILTON

HAMILTON DIVISION
BALDWIN-LIMA-HAMILTON

DIVISIONS: Austin-Western • Eddystone • Hamilton • Electronics & Instrumentation • Lima • Madsen • Loewy-Hydropress • Pelton • Standard Steel Works

For more information fill in page number on Inquiry Card, on page 225

Watch faces light up like a Christmas tree...

... when you put CIMCOOL° on the job in your plant. For CIMCOOL Concentrate—the largest selling chemical cutting fluid in the world—can increase your production and save you money. Here's why:

- **CIMCOOL LOWERS COSTS** because it's longer lasting in machines. Thus, it reduces downtime and cuts labor costs for cleaning and changing.
- **CIMCOOL DOES A BETTER JOB** because of its chemical lubricity. It permits faster speeds and feeds, for it combines friction reduction and cooling capacity in a degree never before attained by old-fashioned coolants.
- **CIMCOOL IS CLEAN,** doesn't soil hands or clothing. It contains no skin irritants. It leaves no slippery film on shoes, floors, machine or work. It can't smoke, can't burn, and virtually eliminates rancidity and foul odors.

See your CIMCOOL distributor for full information on all the advantages of CIMCOOL Concentrate—as well as details on the entire family of CIMCOOL Cutting Fluids.

Or contact us direct and we'll have one of our Cincinnati Milling-trained machinists call on you—without cost or obligation. Write, or telephone Sales Manager, Cincinnati Milling Products Division, Cincinnati 9, Ohio.

°Trade Mark Reg. U.S. Pat. Off.

CIMCOOL CUTTING FLUIDS

CIMCOOL **Concentrate**—The famous pink fluid which still covers 85% of all metal cutting jobs. Effective, economical and clean.

CIMCOOL **Tapping Compound**—Permits the use of highest tapping speeds and increases tap life amazingly.

CIMPLUS The transparent grinding fluid with exceptional rust control. Also used for machining cast iron and as a water conditioner with CIMCOOL Concentrate.

CIMCUT **Base Additive** — For jobs requiring an oil-base cutting fluid. Added to mineral oils, it gives an economical mix for higher speeds and feeds.

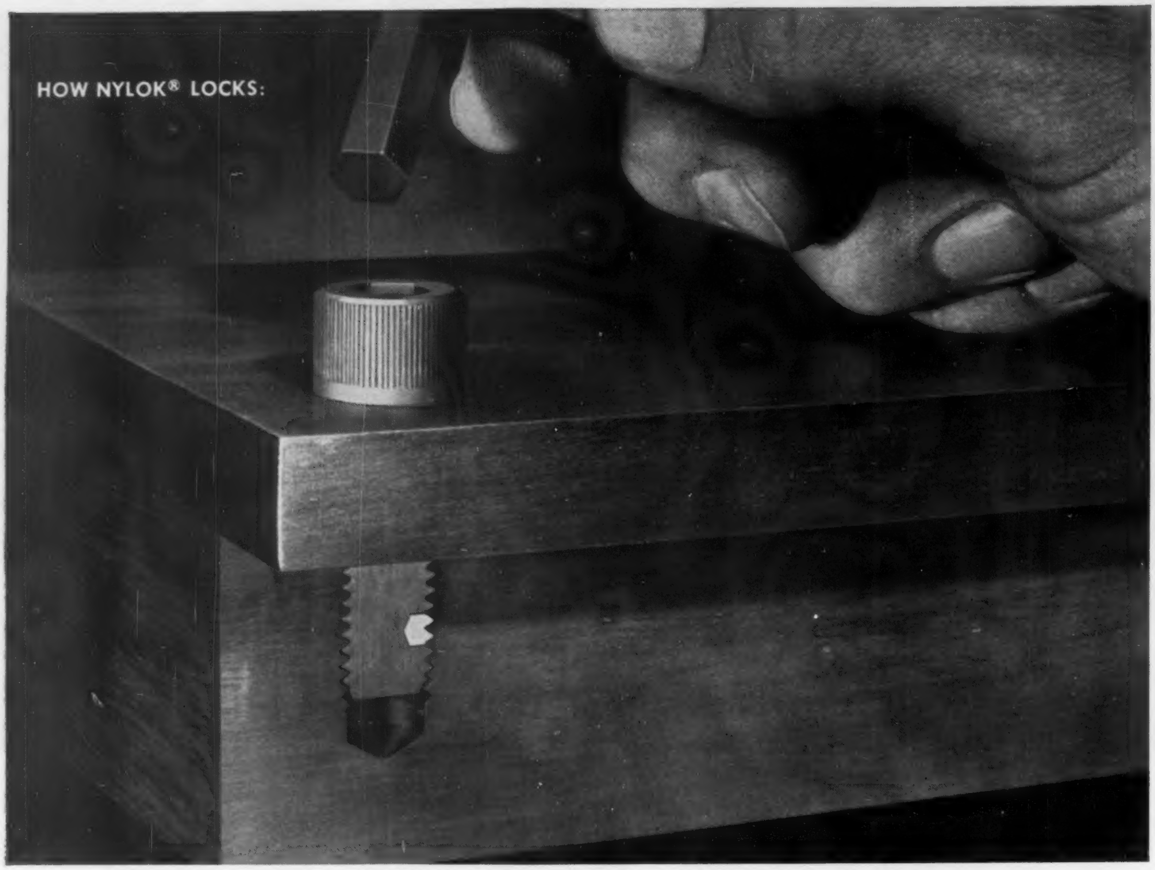
CIMCOOL **Bactericide** — The most effective agent yet developed to overcome rancidity and foul odors.

CIMCOOL **Machine Cleaner** — The two-phase non-corrosive cleaner that removes grit, dirt, slime and oil.

CIMCOOL Cutting Fluids

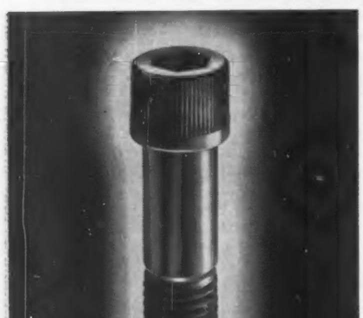
for **100%** *of all metal cutting jobs*

PRODUCTION-PROVED PRODUCTS OF THE CINCINNATI MILLING MACHINE CO.



LOCKED! The tough, resilient nylon pellet keys itself into the mating threads. It forces threads together and locks the screw securely.

NEW—self-locking UNBRAKO socket head cap screws



Self-locking UNBRAKO socket head cap screw.

They won't work loose. And they simplify design and save production time.

UNBRAKO socket head cap screws are now available embodying the Nylok* self-locking principle. Nylok provides the first truly practical solution to the problem of making cap screws self-locking.

An UNBRAKO cap screw with Nylok is a single self-locking unit. No auxiliary locking devices are needed. Just thread the UNBRAKO into any tapped hole. *Seated or not*, it locks positively wherever wrenching stops. The tough, resilient nylon pellet forces mating threads together and holds tight. The screw will not work loose.

You save production time when you make products with self-locking UNBRAKOS. And you get greater simplicity in design with less bulk and weight. The number of parts you must assemble to achieve full locking action is reduced to the absolute minimum. Lockwashers under screw heads are no longer necessary. Costly wiring of cross drilled heads is eliminated. And in many cases you will save weight and mass by using shorter screws in tapped holes instead of drilling through and using nuts and lockwashers.

Self-locking UNBRAKOS are reusable. They have uniform locking and installation torques—with no galling or seizing on mating threads. They successfully withstand temperatures from —70° to 250°F. And, when screws are properly seated, the locking pellet also functions as a liquid seal.

A complete line of self-locking UNBRAKO socket screw products, in a wide range of standard sizes, materials and finishes, is available through your authorized industrial distributor. Technical data and specifications are detailed in Bulletin 2193. Write us for your copy today. Unbrako Socket Screw Division, STANDARD PRESSED STEEL Co., Jenkintown 19, Pa.

**T.M. Reg. U.S. Pat. Off., The Nylok Corporation*

STANDARD PRESSED STEEL CO.

UNBRAKO SOCKET SCREW DIVISION

SPS

JENKINTOWN PENNSYLVANIA

For more information fill in page number on Inquiry Card, on page 225

Production Pointers from GISHOLT

MASTERLINE GISHOLT SINCE 1887

TIME-SAVING IDEAS

Presented as a service to production men, we hope some of these interesting ideas, chosen from thousands of jobs, will suggest ways to help cut time and costs in your own work.

HOW HARLEY-DAVIDSON SPEEDS MOTORCYCLE PART PRODUCTION

Machines Both Ends in Single Chucking, Using No. 12 Automatic with Auxiliary Slide, Special Locator and Tool Relief

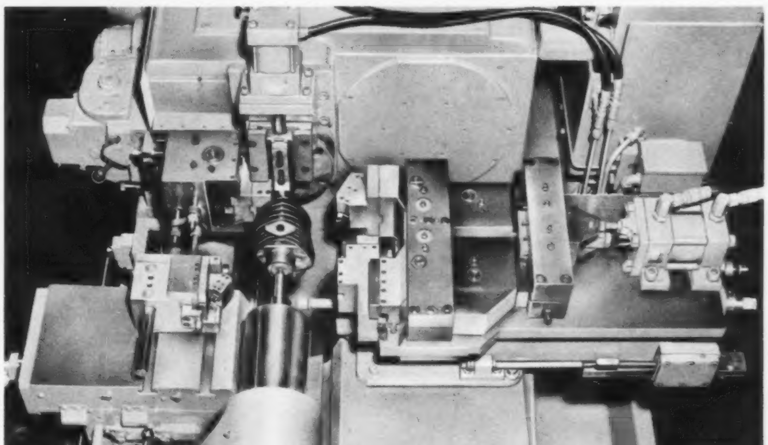
You may spot production ideas here from the way Harley-Davidson Motor Co. of Milwaukee, Wis., is handling cast iron rear and front cylinders.

A Gisholt MASTERLINE No. 12 Automatic Production Lathe is doing the job, machining 6 different sizes and types of workpieces. Smart tooling permits machining the maximum number of surfaces in the minimum amount of time. Change-over is especially fast and easy.

Here's a typical operating cycle: The workpiece is chucked in the rough machined bore on an expanding mandrel. A special headstock-mounted, air-operated locating stop speeds work handling. While tools in the front carriage move longitudinally to turn and chamfer both ends on one side of the piece, tools in a headstock-mounted auxiliary slide—operated through a rack and pinion actuated by front slide movement—move in to chamfer the I.D. on the other side. At the same time, tools on the rear slide move in to face both ends for length. At the end of the cut, tool blocks mounted on the rear independent slide automatically swing open to provide tool relief before withdrawal.

Floor-to-floor time on the part shown is 1.2 minutes. The other 5 workpiece sizes are easily handled by merely changing sleeves on the expanding mandrel and adjusting tools for the smaller sizes, and changing the mandrel itself for larger bore parts. Floor-to-floor times range from 1.8 to 3.6 minutes.

Standard No. 12 Automatic has flexibility to handle variety of parts with minimum change-over. Machining both ends in single chucking gives maximum accuracy, cuts production costs.



Workpiece and tooling, showing headstock-mounted locator, auxiliary slide, and special air cylinder which provides automatic tool relief for rear independent slide tools.

Three different types of workpieces handled, extra expanding mandrel and sleeves.

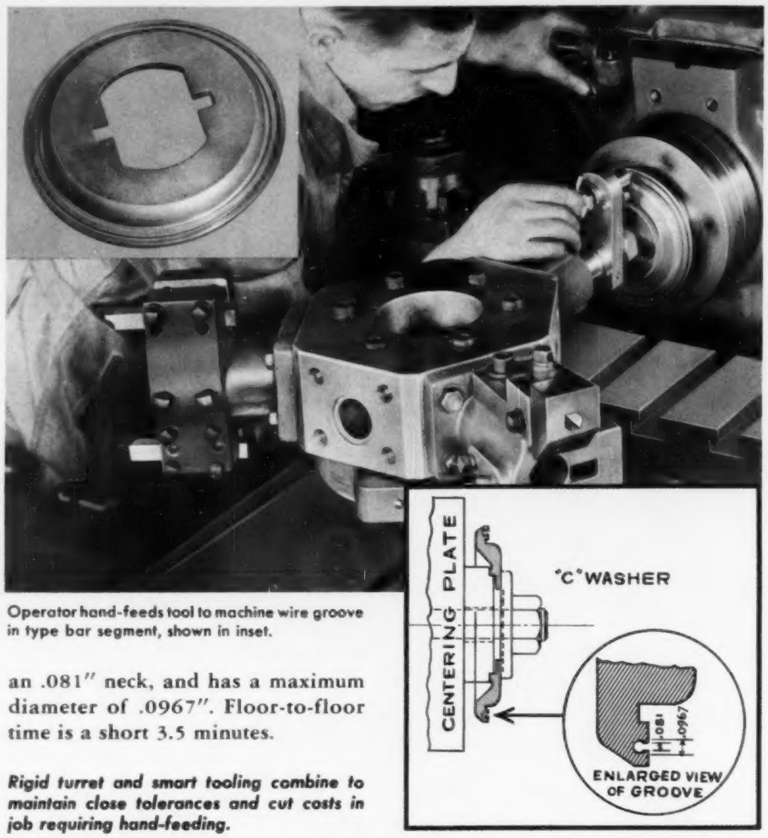
MASTERLINE GISHOLT SINCE 1887

TIME-SAVING IDEAS

REDUCE COSTS NOW WITH

HOLDS DOWN COSTS ON TRICKY OPERATION

Accuracy and Adaptability of No. 4 Ram Speeds Machining of Type Bar Segments



Operator hand-feeds tool to machine wire groove in type bar segment, shown in inset.

There may be a production tip for you in this well-planned setup.

The workpieces are cast iron type bar segments, used in the printing industry. To keep costs at a minimum in an operation involving a close tolerance wire groove—requiring hand-feeding—the manufacturer is using a specially-tooled No. 4 Universal Ram Type Turret Lathe.

The part has been previously machined on one side. Location is on a centering plate, with the part held by a "C" washer and hand-stud. Rough and finish facing are performed by tools in the square turret. Forming and grooving operations are handled by tools on the hexagon turret. The close tolerance wire groove is finished, using a hand-fed tool with an indicator to assure correct depth of cut. The circular groove is cut through an .081" neck, and has a maximum diameter of .0967". Floor-to-floor time is a short 3.5 minutes.

Rigid turret and smart tooling combine to maintain close tolerances and cut costs in job requiring hand-feeding.

AiResearch BALANCES WITHIN "KISS OF A WHETSTONE"

Gisholt 1S DYNETRIC Balancer Puts Ultra-Precision Operation on Production Basis

Checking turbocharger rotating assembly for unbalance. Extremely small amounts of unbalance are measured and located through machine's infinitely variable amplification.

Main product of the shops at AiResearch Industrial Division of the Garrett Corporation, Los Angeles, California, is turbochargers for diesel engines — dynamic, power-boosting accessories operating 40,000 r.p.m. or more.

With machining tolerances held in the "tenths," the job of balancing these assemblies is so close and critical that it must be "within the weight of metal removed by a whetstone stroke"! Here's how AiResearch is doing it—using a Gisholt 1S DYNETRIC Balancer.

For maximum accuracy, the components are balanced individually and as an assembly. Parts are rotated at 1500 r.p.m., with the standard stroboscopic lamp indicating exact angle of unbalance—and the amount meter telling the exact amount in terms of correction method employed.

Required accuracy is easily met by the standard Gisholt 1S, balancing the shafts to within 0.02 gram-inches, the compressor wheel to within 0.07, and the hot wheel to within 1.8 gram-inches. The same machine statically balances the exuder of the turbocharger to within 1 gram-inch.

Variety of parts and assemblies is handled on high-production basis with Gisholt 1S Balancer, without loss of accuracy and with minimum setup and change-over.

Write for free copy of Bulletin 1109-B, giving basic information on theory of balancing and on the complete line of Gisholt Balancing Equipment.

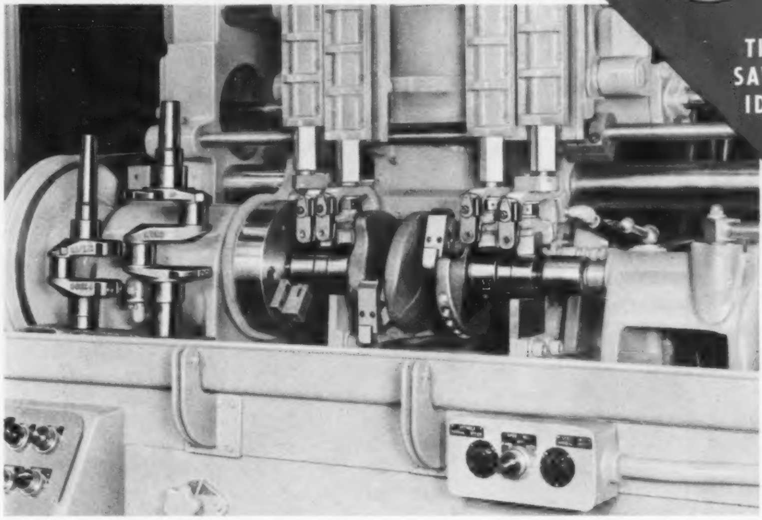
GISHOLT

LOOK AHEAD... KEEP AHEAD... WITH GISHOLT

TIME-SAVING IDEAS

WHAT ONAN IS DOING WITH SUPERFINISH

Handles Crankshaft Mains, Pin Bearings and Oil Seals Simultaneously—Gets Finer Finish at Lower Cost


Model 51A Superfinisher, showing crankshaft in place and 2 other sizes at left. Special upper-oscillating Superfinishing heads are used. Although machine has automatic cycle, note control buttons permitting manual operation if desired.

This pointer reveals how D. W. Onan and Sons, Inc., Minneapolis, has put crankshaft finishing on a high-production basis—using a Gisholt Model 51A Superfinisher.

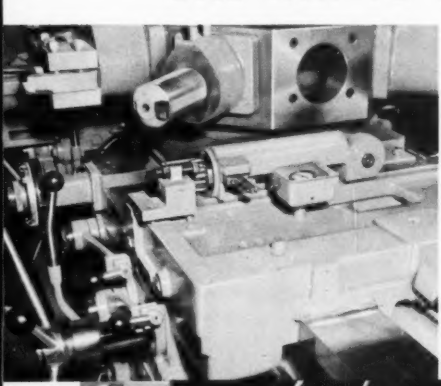
The machine is tooled to handle up to 6 different diameters in one operation, on a variety of single- and 2-throw crankshafts. Loading and unloading of larger crankshafts are made fast and simple, with loading rails and special spindle-inching arrangement to position the driver.

Here's a typical operating cycle: Crankshaft is placed between centers, driving from keyway with faceplate driver. Two special latch-on, follower-type arms are engaged with the crank pins and 4 longitudinally adjustable quills descend to Superfinish main bearing and oil seal surfaces. The main and pin bearings are taken from a ground surface of 30 micro-inches down to 8 or less. The oil seal surfaces on the shaft ends are Superfinished down to 4 micro-inches RMS, or less.

Here, Superfinishing handles 44 to 53 pieces per hour with 80% efficiency—with 1-hour change-over from one crank size to another. Each set of stones Superfinishes over 200 crankshafts on this job.

ONE WAY TO TRIM COSTS IN SHEAVE PRODUCTION

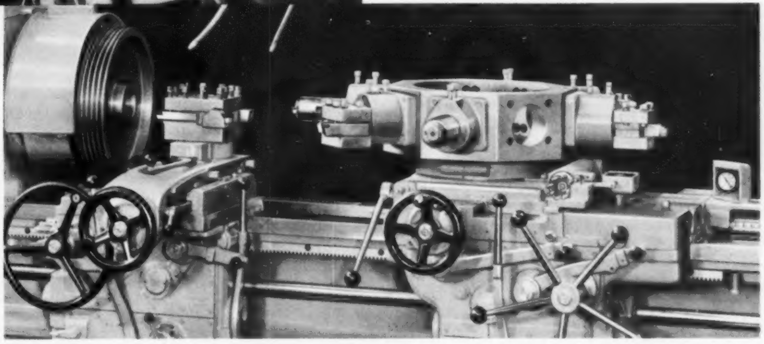
3L with Octagon Turret Provides Ample Capacity to Handle This Job and Variety of Other Work



Simple jobs like this prove the value of cost-cutting special features on the Gisholt 3L Saddle Type Turret Lathe.

"Tenth" indicators assure maximum accuracy, reduce possibility of operator errors. Cross-feeding turret stop roll simplifies operation on cross-feeding cuts.

Workpiece shown after second operation. Standard tools on the cross-feeding turret keep costs at a minimum.



Workpieces are 20" diameter cast iron sheaves, machined in 2 fast operations. Tooling costs are held to a minimum through use of the cross-feeding octagon turret, which lets standard tools perform facing, forming, boring and chamfering operations. Tools on the square turret turn the O.D. and face the rim of the part, form the grooves on the O.D. and also chamfer.

Special features on the 3L improve accuracy and reduce setup time. The 8-position cross-slide stop roll is used to automatically trip cross-feeding movements of the turret. "Tenth" indicators simplify and speed up cross and longitudinal positioning, and make it easier to work to the accuracy required on these parts.

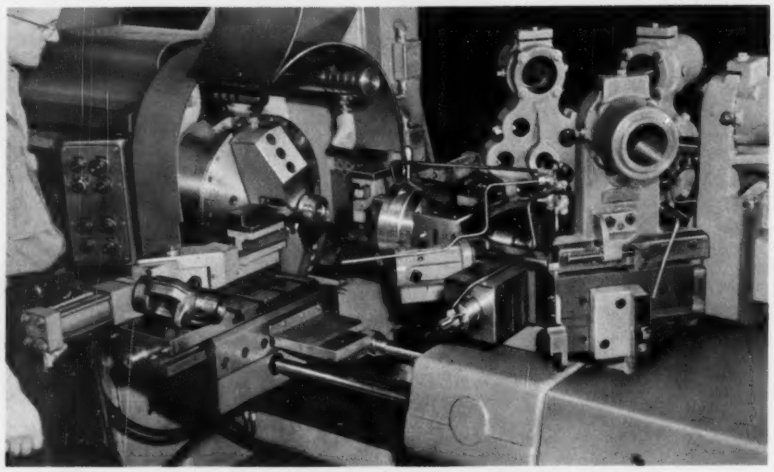
3L has versatility to machine sheaves to high degree of accuracy in minimum time, plus necessary capacity to handle all types of intricate jobs. "Tenth" indicators and turret stop rolls simplify work.

MASTERLINE GISHOLT SINCE 1887

TIME-SAVING IDEAS

HOW EDWARD VALVES DIV. MACHINES, THREADS WITH FASTERMATIC

Threading Operation, Reverse of Spindle Included Within Automatic Cycle



MASTERLINE Fastermatic with octagon turret, tooled to perform first machining operations on 1½" steel Univalve bonnet forgings.

You'll like the way Edward Valves Division of Rockwell Mfg. Co., East Chicago, Indiana is machining 1½" steel Univalve bonnets with this setup.

The machine used is a new Gisholt 2F MASTERLINE Fastermatic Automatic Turret Lathe.

The job is completed in 2 chuckings, working with an 18" 2-jaw hydraulically operated chuck. In each operation the octagon turret carries necessary tools to handle all external and internal work, with facing completed from front and rear cross slides.

The first operation is on the bonnet end of the part. Threading the O.D. is part of the automatic cycle, using a collapsible die head. A 2-speed motor provides correct spindle speed.

In the second operation the I.D. is threaded on the other end, with the spindle automatically reversing to withdraw the tap. Operator's job is made easy through features like electric toggle switch control panel to simplify setup—permanent gauge on octagon feed cam drum for quick positioning during changeover—automatic positioning of spindle at end of cycle to simplify loading and unloading operations.

Floor-to-floor time for the first operation is 8.5 minutes (including drilling, counter-boring and threading) and 2.8 minutes for the second operation to finish the valve seat.

Octagon turret provides tool capacity to complete job in 2 chuckings. Automatic cycle eliminates human error, lets operator handle additional units or do other work.

SIMPLIFIES LOADING OF COMPRESSOR DISCS

Air-Operated Pusher on Simplimatic Assures Positive Location

Here's how the addition of a simple device has reduced operator fatigue and improved over-all efficiency. The device is an air-operated pusher, used on the Gisholt Simplimatic Automatic Lathe to speed work loading.

Workpieces are 24" diameter, aluminum compressor disc forgings for jet engines. Ordinarily, the large diameter and thin web section of this type of part make accurate locating and chucking especially difficult. With this setup, the operator simply moves the part into position and actuates the air-operated pusher, which holds the work firmly against locating stops while it is being chucked. Wide jaws are used to eliminate distortion.

All tooling is carried on standard slides, mounted at correct angle on wide platen table which—after chucking—feeds forward to engage tools with work. The rear slide is mounted at an angle to let tools perform an angular facing operation, while tools on the front slide machine 4 other faces and rough-turn the flange diameter. F.t.f. time is just 5.5 minutes.

Air cylinder in foreground pushes workpiece against locating stops to simplify chucking part before machining operation starts. Table feed saves special tooling costs by engaging tools with work before standard slide movements begin.

Special device on Simplimatic makes loading faster, easier. Wide platen table promotes easy mounting of tool slides to correct angle for maximum efficiency.

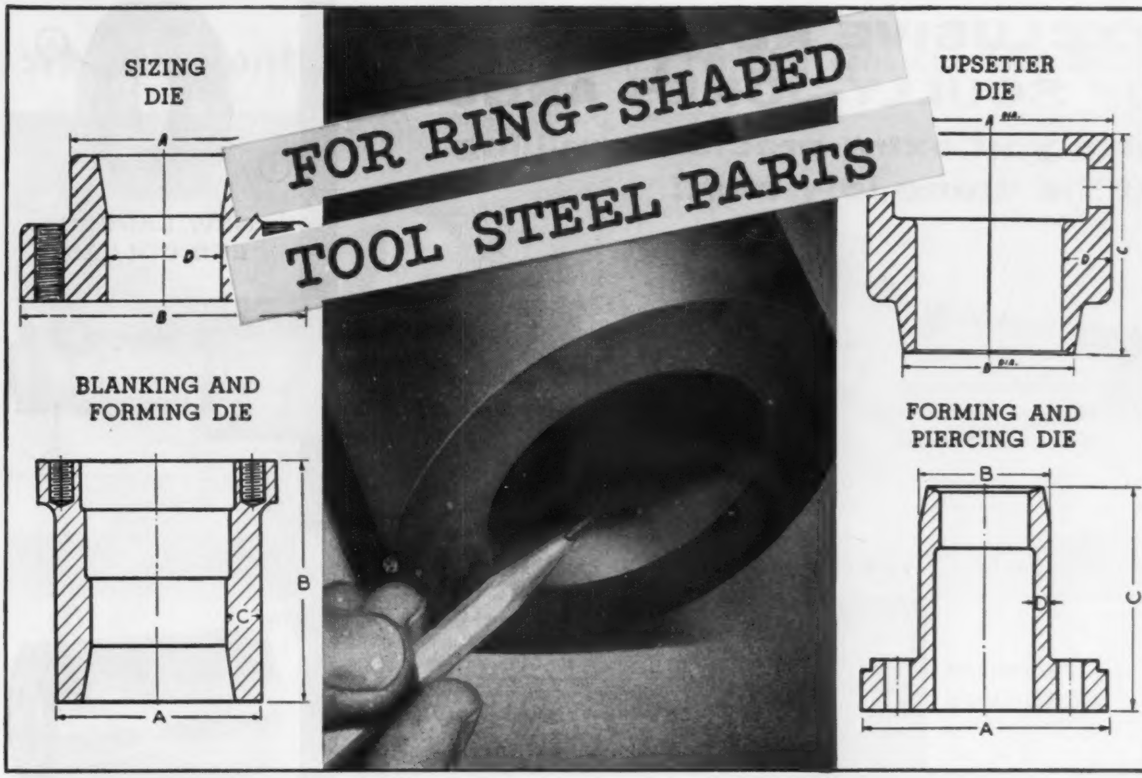
11-1256
668

THE GISHOLT ROUND TABLE represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

GISHOLT

GISHOLT MACHINE COMPANY Madison 10, Wisconsin

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES



New Graph-Mo Hollow-Bar eliminates drilling, machines 30% faster

MAKERS of ring-shaped tool steel parts who use Graph-Mo Hollow-Bar will tell you it speeds up production, cuts down waste, and saves steel. That's because the hole is already in it. There's no drilling, you start with finish boring.

What's more, you get all the proved advantages of Graph-Mo that have made it one of the most popular tool steels—excellent machinability, wearability, and stability.

Graph-Mo machines 30% faster than other tool steels and has a minimum tendency to scuff or gall. The combination of free-graphite and diamond-hard carbides in its structure gives it exceptional wearability. Users report that Graph-Mo outwears other tool steels on an average of 3 to 1.

Graph-Mo also is the most stable tool steel ever made. For instance, a Graph-Mo steel master plug gage showed less than 10 millionths of an inch in dimensional change after 12 years of use. And Graph-Mo responds uniformly to heat treatment, too.

If you make ring-shaped tool steel parts, make sure you get all the advantages of Graph-Mo Hollow-Bar. Sizes range up to 16" O.D. with a variety of wall thicknesses. It's made by the specialists in fine alloy steels, The Timken Company.

Graph-Mo Hollow-Bar is distributed through A. Milne and Co. and the Peninsular Steel Co. warehouses.

To find out more about this tool steel, write The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

YEARS AHEAD—THROUGH EXPERIENCE AND RESEARCH

SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS TUBING

For more information fill in page number on Inquiry Card, on page 225

Why the Contract Shop Owner Prefers PRODUCTO Die Sets

They help protect his profits

The contract shop owner prefers Producto die sets because they help protect his die performance...his delivery promises...his profits.

The shop owner favors Producto because he can choose from a wide range of die set styles and thicknesses in steel, semi-steel or a combination.

He knows that when his dies are mounted in Producto sets, they will retain the precision built into them. He can expect maximum die life, maximum production with minimum press downtime for regrinding.

The shop owner likes the fact that Producto offers him a choice of two classes of precision, and that *he pays only for the amount of precision he buys.*

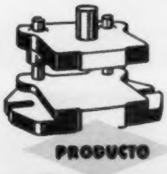
He knows that whoever handles the die will spend the least possible time taking it apart and putting it together because Producto's Qwik-Fit Guide Pins minimize die set assembly problems.

Most important, the shop owner can depend on efficient Producto service and strategically-located Producto distribution centers to protect the delivery promises he makes to *his* customers.

When the contract shop owner thinks in terms of protecting his profits, he thinks of Producto die sets and accessories. You should, too.

NEW DIE SET CATALOG No. 11 is another reason the shop owner prefers Producto. It makes selection and ordering really easy. Write for your free copy today. And ask to receive Die Set Digest, too.

THE PRODUCTO MACHINE COMPANY
985 Housatonic Ave., Bridgeport 1, Connecticut



PRODUCTO **Wherever die sets are used**

PRODUCTO

PRODUCE MORE WITH PRODUCTO PRECISION DIE SETS


CINCINNATI

A "natural" for aircraft parts
New! Revolutionary!
Colonial ONE-WAY Surface Broacher
"Eliminates" Return-Stroke
"Eliminates" End of Stroke
"Doubles" Length of Stroke
For complete information on the new Colonial ONE-WAY surface broacher, ask for Bulletin VC-55
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VARIABLE SPEED
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EXTREME ACCURACY GUARANTEED
STROKE LENGTH UP TO 200 INCHES
SPEEDS UP TO 50 FEET/MIN.
ONE LONG STROKE— ONE PART OR MULTIPLE SHORT STROKES ON MULTIPLE PARTS
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Two of America's Most Modern

22 BLISS HYDRO-DYNAMIC PRESSES WORK FOR BOTH ARMY AND NAVY AT EKCO PRODUCTS

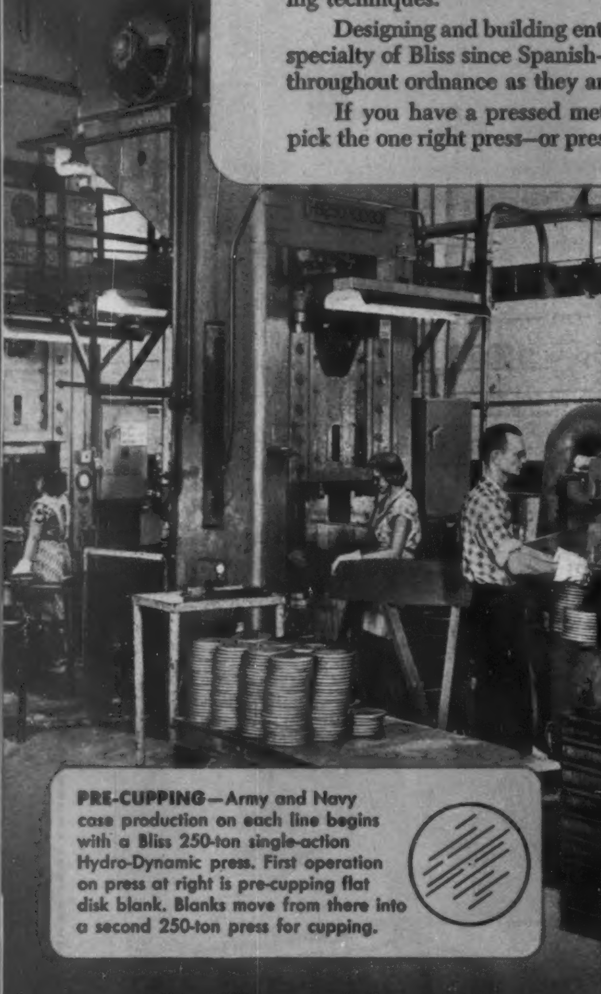
At Ekco Products Company, Chicago, one line of Bliss presses ranging from 75 to 2500 tons produces 76 mm cartridge cases...and another line of eleven makes 3"/50 Navy cases.

The speed at which the lines are operated is "classified" information, but you may be sure it is exceptionally fast. As a matter of fact, their performance so exceeded their original "specs" that the lines have become known throughout the ordnance world.

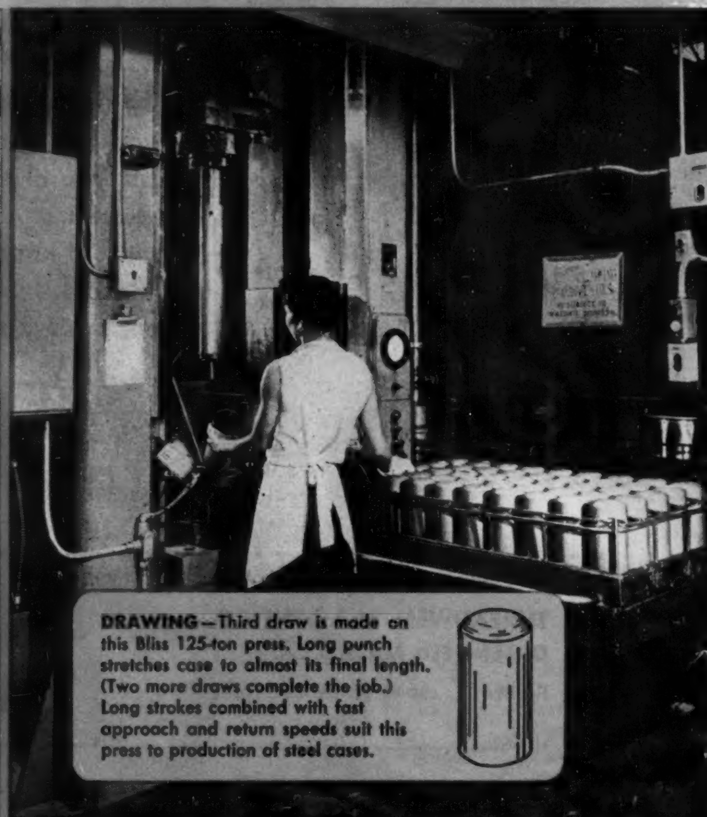
Press operations on both lines are the same—a series of eleven steps beginning with pre-cupping a steel blank, then cup, four draws, pre-head, final draw, heading, and two tapering operations. Only difference between the Army and the Navy lines is a slight variance in tapering techniques.

Designing and building entire ordnance lines, both hydraulic and mechanical, has been a specialty of Bliss since Spanish-American War days. Today, Bliss press lines are as common throughout ordnance as they are throughout industry at large.

If you have a pressed metal problem, put this experience to work—let Bliss help you pick the one right press—or press line—for the job.



PRE-CUPPING—Army and Navy case production on each line begins with a Bliss 250-ton single-action Hydro-Dynamic press. First operation on press at right is pre-cupping flat disk blank. Blanks move from there into a second 250-ton press for cupping.



DRAWING—Third draw is made on this Bliss 125-ton press. Long punch stretches case to almost its final length. (Two more draws complete the job.) Long strokes combined with fast approach and return speeds suit this press to production of steel cases.

BLISS
SINCE 1857

is more than a name... it's a guarantee

E. W. BLISS COMPANY, Canton, Ohio

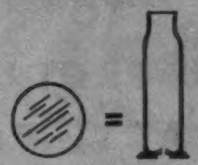
Presses, Rolling Mills, Rolls, Special Machinery

Steel Cartridge Case Lines

HYDRO BLISS DYNAMIC

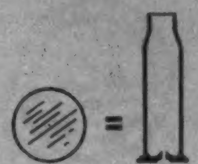
Eleven Press Operations On Each Line

ARMY



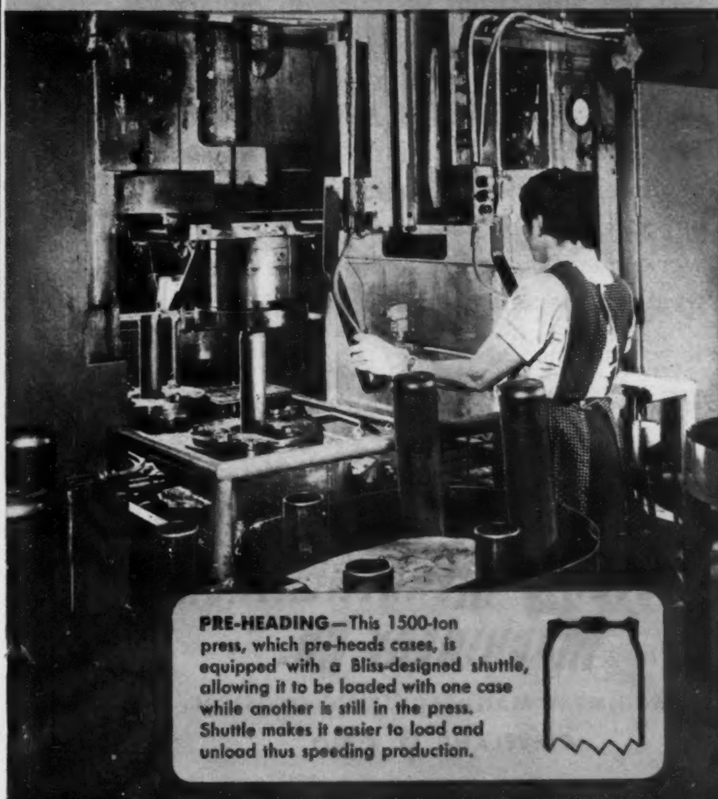
From this...to this

NAVY

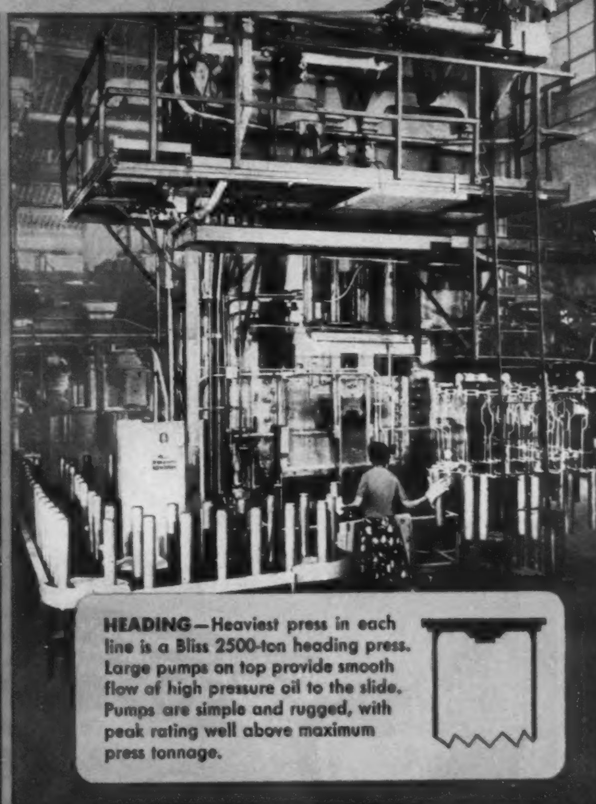


From this...to this

OPERATION	PRESS	CAPACITY
1. Pre-Cup	Bliss HS250	250
2. Cup	Bliss HS250	250
3. First Draw	Bliss HS200	200
4. Second Draw	Bliss HS150	150
5. Third Draw	Bliss HS125	125
6. Fourth Draw	Bliss HS100	100
7. Pre-Head	Bliss HS1500	1500
8. Fifth Draw	Bliss HS75	75
9. Head	Bliss HS2500	2500
10. First Taper	Bliss HS75	75
11. Second Taper	Bliss HS75	75



PRE-HEADING—This 1500-ton press, which pre-heads cases, is equipped with a Bliss-designed shuttle, allowing it to be loaded with one case while another is still in the press. Shuttle makes it easier to load and unload thus speeding production.



HEADING—Heaviest press in each line is a Bliss 2500-ton heading press. Large pumps on top provide smooth flow of high pressure oil to the slide. Pumps are simple and rugged, with peak rating well above maximum press tonnage.

U. S. Plants: Canton, Cleveland, Salem and Toledo, Ohio; Detroit and Hastings, Michigan; San Jose, California, Midland and Pittsburgh, Pa. *Branch Offices:* Boston, Burbank, Chicago, Cleveland, Dayton, Detroit, Indianapolis, New Haven, New York, Pittsburgh, Philadelphia, Rochester, Salem, San Jose, Toledo, Washington, D. C. and Toronto, Canada; E. W. Bliss (England) Ltd., Derby, E. W. Bliss Co., (Paris), France. *Other representatives throughout the world.*

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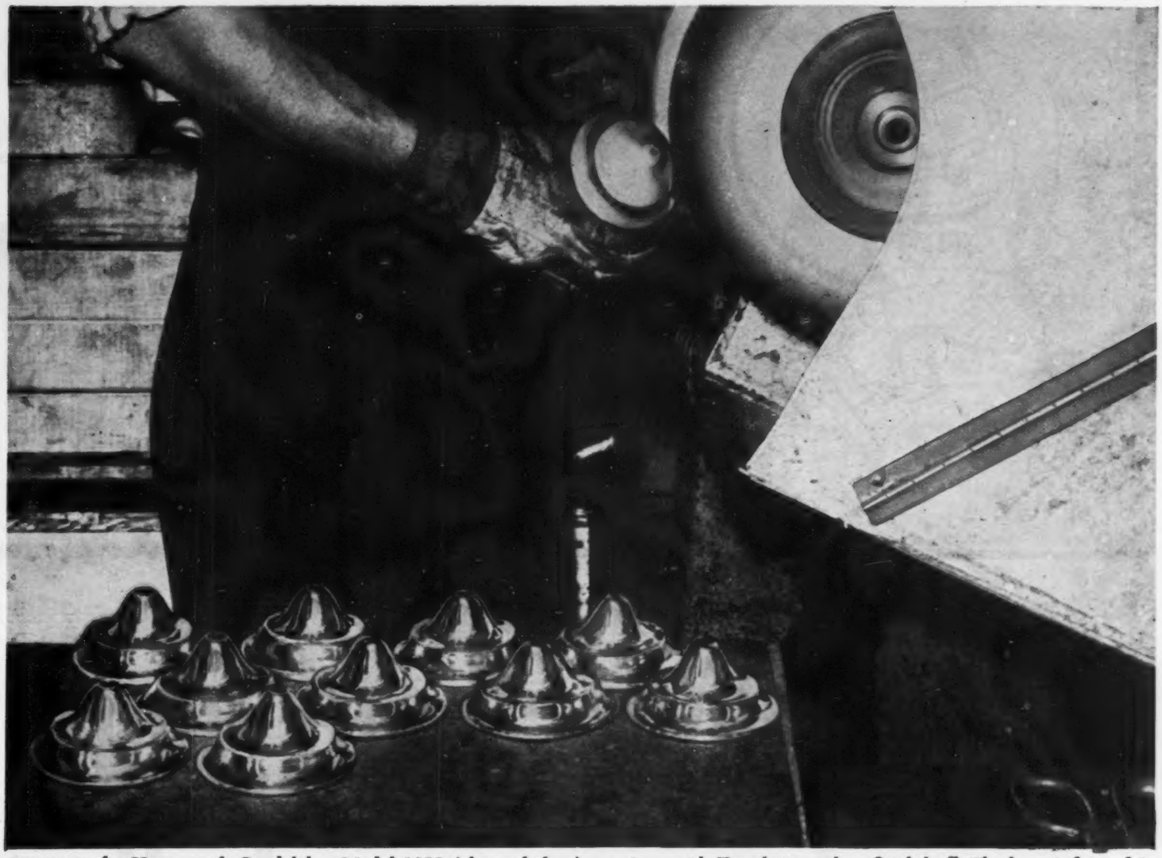
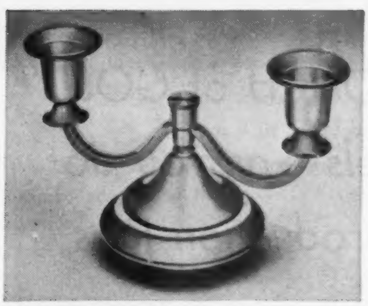


THE BASE of a Huntercraft Candelabra Model 8008 (shown below) requires, with Formbrite, only a finish buff. The base is formed in two drawing operations. The deeper drawn candle cups, also of Formbrite, need only a light cutting with Tripoli and a finish buff.

It's easy to get a jeweler's finish with Formbrite



HUNTERCRAFT Table or Wall Candelabra Model 8008, one of 30 fine brassware items in the line of Huntercraft Originals.

"Formbrite cut polishing cost and time dramatically—was a major factor in keeping our small business alive . . . and growing," says Ralph E. Hunter of Huntercraft.

The production of Huntercraft Originals—now a nationally distributed line of fine brassware—has grown from a basement hobby to a thriving new business in less than 5 years.

The Hunter Machine Service Company of Racine, Wisc., began manufacturing Huntercraft Originals on a commercial scale in 1951, using ordinary soft forming brass. To get the gleaming jeweler's finish required, polishing time and costs were high. In fact, they were so high that the young company found it impossible to bring their prices into line with competition.

In 1953, they tried Formbrite®, Anaconda's superfine-grain drawing brass. The polishing bottleneck was broken and production soared – unit costs went way down. According to Ralph E. Hunter, owner and president of Hunter Machine Service Co., Formbrite was a major factor in keeping the company alive and enabling it to go on to become a stable, growing business. The finish obtained so easily on Formbrite, he adds, is superior to that achieved on ordinary drawing brass.

Formbrite is a premium product at a nonpremium price. Find out for yourself how its superfine-grain, excellent drawing properties, strength, and scratch-resistance can help you make a better product at lower cost. Write for Publication B-39. Better yet, ask for a sample or a trial batch. Address: The American Brass Co., Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont. 5672

Formbrite SUPERFINE-GRAIN DRAWING BRASS

an ANACONDA® product

made by The American Brass Company

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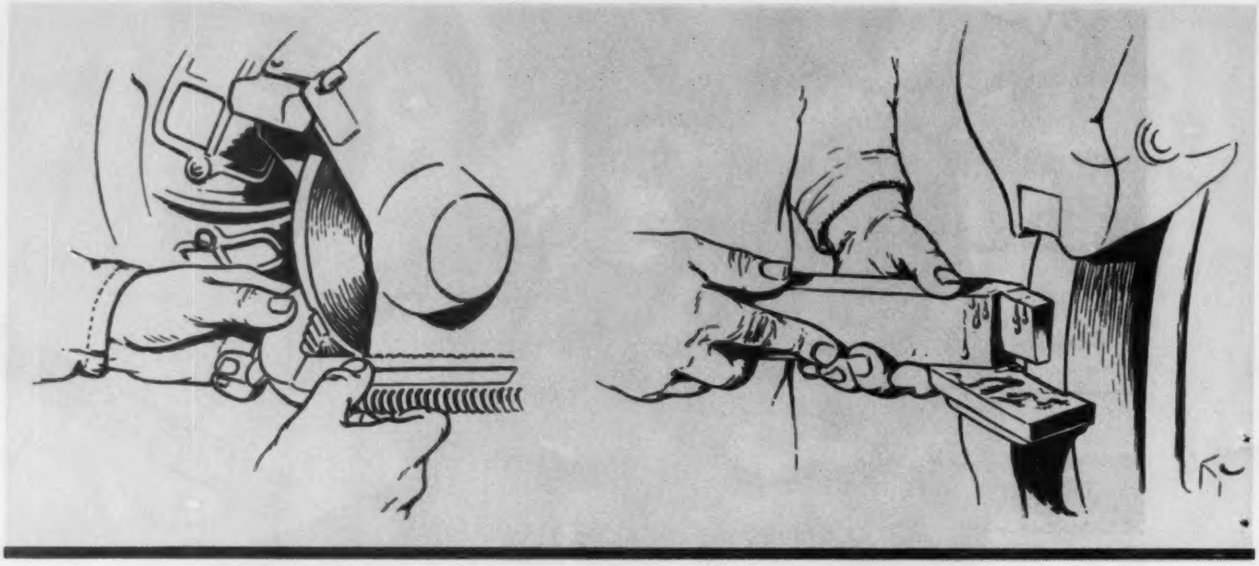

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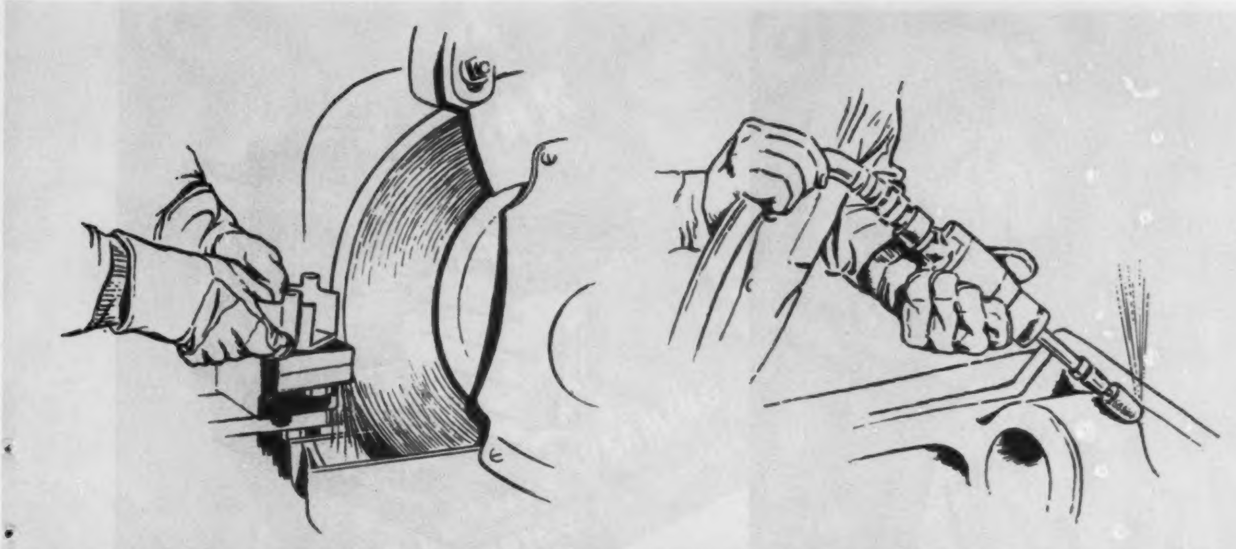
You get the same profit-boosting "TOUCH of GOLD" from Norton general purpose wheels—as you do from the Norton wheels on your production jobs

Remember this about your general purpose bench and floor stand grinding, and mounted wheel operations . . . *Norton builds wheels that save you the most time and money across the widest range of grinding jobs* . . . whether it's a lowly bench stand or a high production, high precision grinder.

This includes wheels in every abrasive-and-bond combination you need, for every type of grinding. In particular, 44 ALUNDUM* abrasive is the new, revolutionary Norton development that's tops among all non-premium priced aluminum oxide abrasives. It's a proved fact that tough, versatile "44" wheels are now solving plenty of grinding problems for new users — with outstanding performance for less money.



So easy for you to get

Your Norton Distributor, one of over 315 in the United States alone, is your contact with the largest, most efficient service and supply system in the entire abrasive field. He'll give you fast deliveries on the wheels you want. And you get more good service by asking him for details on how Norton wheels — including the 44 ALUNDUM abrasive newcomers — will bring the product-improving, profit-boosting "Touch of Gold" to every one of your general purpose grinding jobs.

Ready for you — and full of facts and prices

This latest Norton wheel catalog brings you plenty of information and recommendations on the types of wheels that will give you best results in your particular grinding jobs. List prices are there, too — and also included is a brand new supplement covering discount net prices for the complete line. Get it now from your Norton Distributor. Or write to the nearest district office of NORTON COMPANY, Worcester 6, Mass. Distributors in all industrial areas, listed under "Grinding Wheels" in your phone book, yellow pages. Behr-Manning Company, Troy, N. Y., division of Norton Company. *Export:* Norton Behr-Manning Overseas Incorporated, Worcester 6, Mass.

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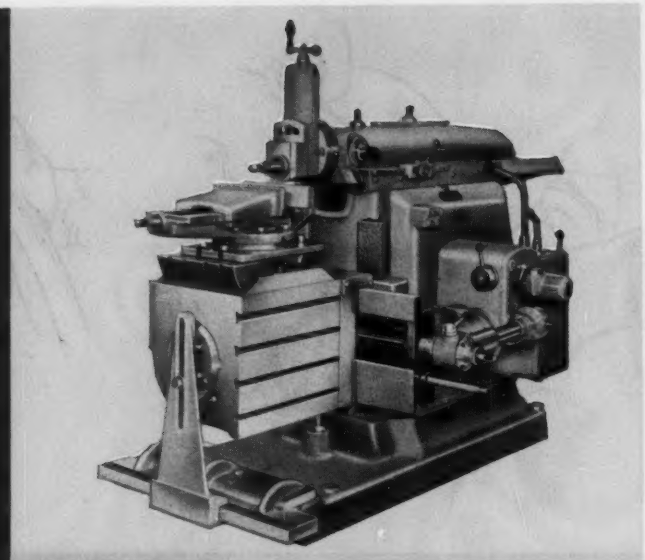

VMA Universal Shaper Model ES-26

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(SUPERB CRAFTSMANSHIP)

VMA SHAPERS - built by Sweden's master craftsmen - are engineered to maintain precise tolerances in continuous heavy-duty production. Built to U. S. standards, VMA Shapers—both heavy duty and standard models — meet all requirements for modern versatile machines.

VMA Model ES Heavy Duty Shapers, available in Plain and Universal Models and with 18", 22", 26", and 28" stroke, feature:

- Wide selection of ram speeds and power feeds
- Automatic forced lubrication system
- Horizontal power rapid traverse of table through independent motor
- Double helical crank gear
- Chrome nickel steel transmission
- Anti-friction bearings throughout
- Dependable safety clutch

VMA Model EV Series... economical standard-duty Shapers with stroke lengths from 14" to 24".

- Highly accurate and dependable, Model EV Shapers are ideal for job shop or tool room use not requiring the extra power of the ES Series. Easy to operate — economical to own.

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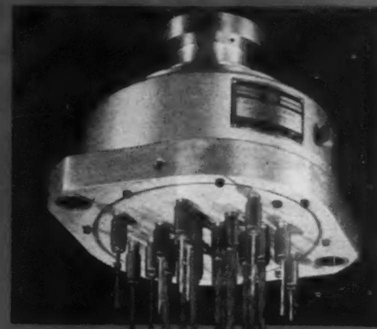

Any hole pattern — on any center up to 1½" dia.

Zagar's Broad-Scope Engineering SOLVES ANY HOLE PROBLEM

Zagar meets every drilling problem with the most effective, low cost equipment: gearless drill heads, standard drilling machines, special drilling machines, and index, trunnion or pallet-type multi-station transfer machines. We can furnish the complete tooling if you desire. Perhaps Zagar drill heads can be installed profitably on your own drill press. Send us a drawing of the part you are planning to drill. Or, let us study your present situation with a view to reducing your drilling cost.

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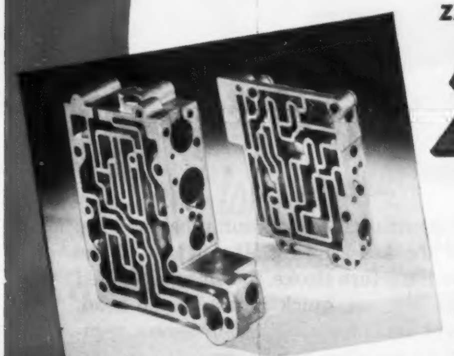
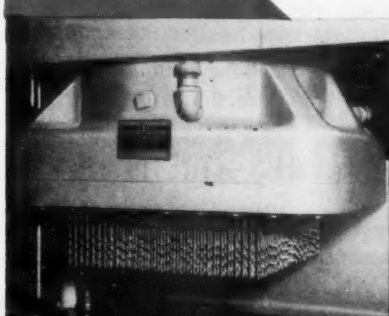
TOOLS FOR INDUSTRY and SPECIAL MACHINERY

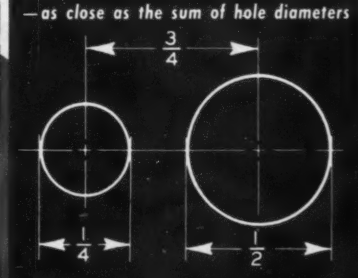


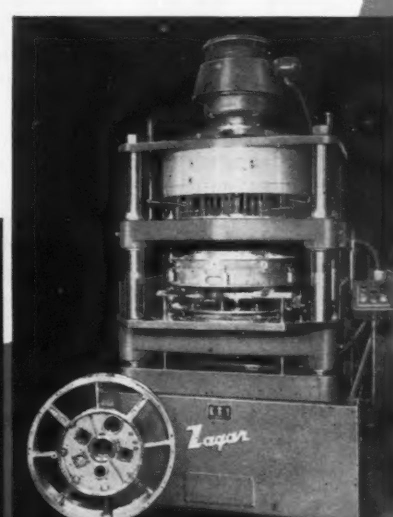
Any machinable material — from all angles.



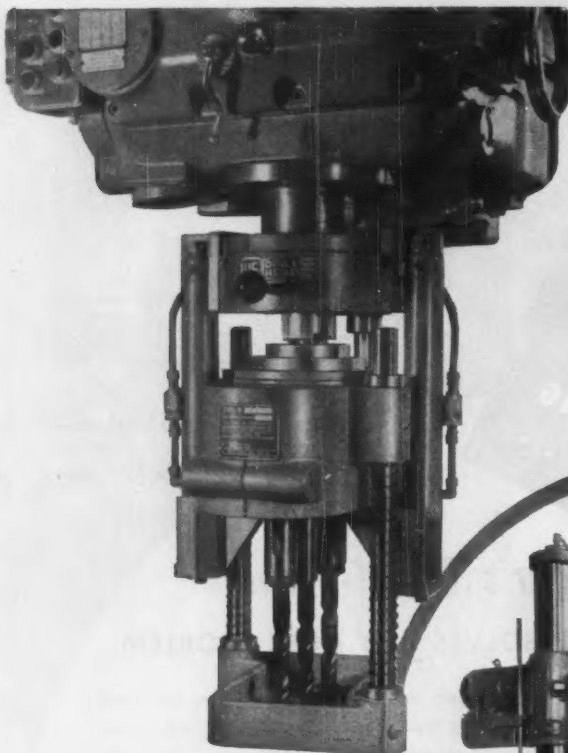
Up to 1000 holes can be drilled IN ONE PASS.

—as close as the sum of hole diameters





4-post ram-type drilling machine for aircraft parts.



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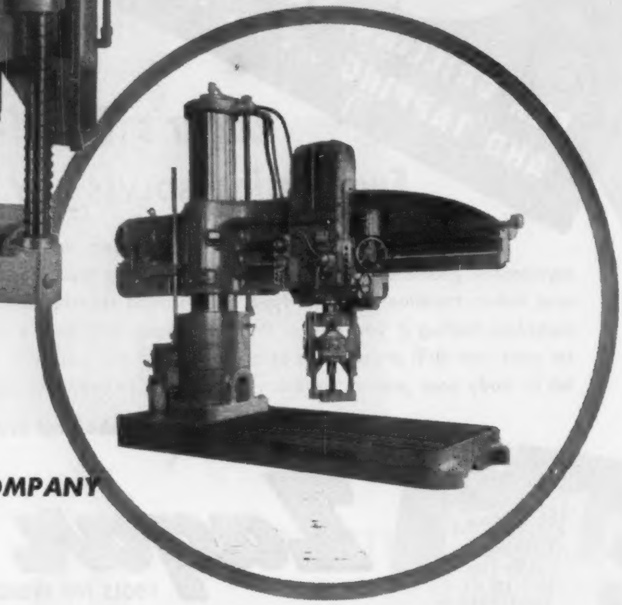
DRILL HEAD

AIR COUNTERBALANCE SWIVEL ATTACHMENT

FOR RADIAL DRILLING MACHINES



THIS IS ANOTHER <u>FIRST</u> FOR THE U. S. DRILL HEAD COMPANY

This new combination Swivel and Air Counterbalance attachment makes it possible to adapt large multiple spindle drill and tapping heads to radial drilling machines.

Flexible and easily adjusted, it insures maximum safety for the operator, as well as better operating economy.

Two cylinders maintain a balanced condition of the head on the machine, with the air in the counterbalancing setup being controlled on both ends of the stroke. Therefore, only sufficient pressure is maintained to counterbalance the weight of the head during all portions of the stroke. On the return stroke, the air is controlled to prevent extreme, quick return of the head. Attachment includes air filter, pressure regulator, and an air oiler, and incorporates a 360° swivel feature fully aligning the drill head. It operates equally well with the fixed center type head and the adjustable type head.

This package is ideally suited for drilling condenser plates, boiler tube sheets, flue sheets, etc.

FOR MEN WHO KNOW DRILL HEADS BEST, IT'S ALWAYS U. S. DRILL HEAD — FIVE TO ONE

Manufacturers of all types of Fixed Center, Adjustable, and Individual Lead Screw Tapping Heads.

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THE UNITED STATES DRILL HEAD COMPANY

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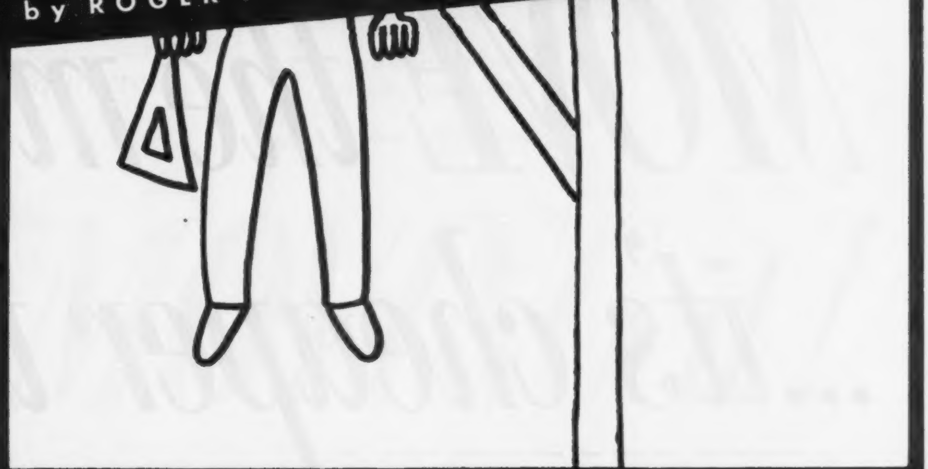
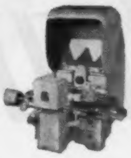
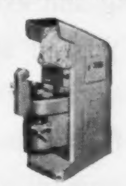




Bench Model BC-7D

Floor Model FC-30



Floor Model FC-14

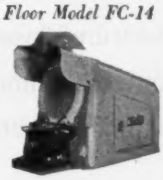


Table Model TC-14
(Vertical Inspection)

"HIGH-STRUNG ENGINEER"

This cleverly-drawn Droodle is just a joke, because everyone knows that engineers really aren't high-strung at all. They're all rugged, handsome, good-natured chaps who puff placidly on bulldog briars while they're doping out various ways to square the circle, and how to get another year out of the family jalopy. Oh yes, I was an engineer once! Until one day the boss, who was inspecting one of my blueprints, remarked "Price, you're funny!" On the spot, I decided to become a humorist. That's the very same spot I was fired on, incidentally.

Not at all incidentally, I'd like to put in a good word for a friend of mine, the Jones & Lamson Optical Comparator. This precision-built instrument is used throughout industry to inspect and measure all sorts of parts and objects. The J&L Comparator is speedy, and accurate to .0001″. It's extremely flexible, too . . . can be used for the toughest inspection jobs, and pays its own way both in production-line and job-shop work. Available in eleven bench and floor models. Get all the details on Jones & Lamson Comparators . . . write to Dept. 710 *today.*

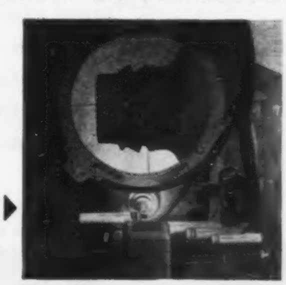
JONES & LAMSON OPTICAL COMPARATORS *On the Job . . .*

at Ingersoll-Rand Company, Phillipsburg, N. J.

A J&L Comparator performs production-line inspection of form tools and gages. This helps to minimize scrap, and insures top quality in the manufacture of rock-drilling equipment.

at A. H. Wirz Inc., Chester, Pa.

A J&L Comparator checks the necks, threads and other elements of the many different sizes and types of fold-up metal tubes, that are used for cosmetics, pharmaceuticals, etc.



JONES & LAMSON

JONES & LAMSON MACHINE COMPANY, Dept. 710, 512 Clinton Street, Springfield, Vt., U. S. A.

Please send me Comparator Catalog 402-C, which describes the complete line of J&L Optical Comparators.

name ________ title ________ street ________

company ________ city ________ zone ________ state ________

The Big Trend in Metalworking...

MOVE the metal ...it's cheaper than

HOW NEW METHODS SAVE BIG SUMS

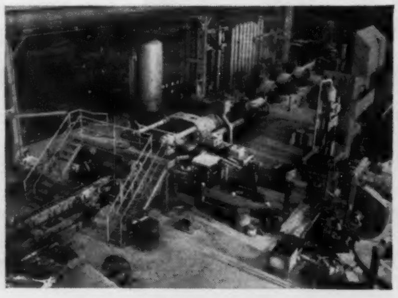
A. Parts are produced primarily by forcing metal into the desired shape rather than by "removing" or "machining" it. It is far faster... saves tremendously in time and labor.

B. The amount of metal in the initial slug, shot, billet, sheet, etc., is only slightly more than the total amount in the finished piece. Thus scrap and machining are held to an absolute minimum.

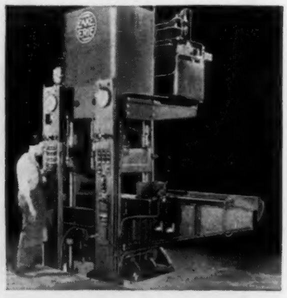
Metalworking plants casting about for ways to reduce production costs are turning more and more to the newer methods of forging, drawing and extruding in which metal is being "pushed around" rather than "removed." These processes basically are the hot extrusion of alloy steel, cold "pressure" forging of aluminum, cold extrusion of steel, and high pressure closed die extruding of aluminum and other non-ferrous alloys. Also falling within this category

Closed die extruding of heated aluminum reduced production time 99%.

Cold steel extrusion reduced scrap 43%.



Hot alloy steel extrusion is now an established art.



Metal powder parts are often produced with no machining.

New and improved production techniques save millions…arouse widespread interest

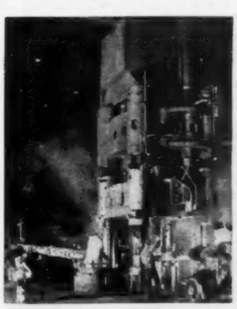
1. Actual parts production is cut from hours in typical cases to minutes or even seconds.
2. Pieces generally have superior finish and improved physicals including grain structure.
3. Tolerances and uniformity equal or better those of older methods.
4. Scrap is greatly reduced and in many cases practically eliminated.
5. Unit costs go way down.

REMOVING it!

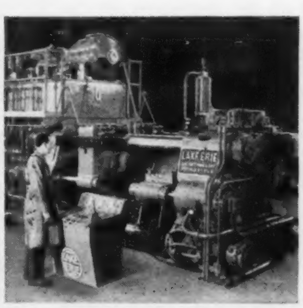
are somewhat older though greatly changed and improved methods for the extrusion of aluminum, hot forging of ferrous metals, powder metallurgy, deep drawing of sheet and die casting. The most recent developments involve variations and combinations of the above applied to many products and materials. Our engineers are in close daily contact with these developments. They'll be glad to help apply any of them to your production. Call or write us.

LAKE ERIE HYDRAULIC PRESSES

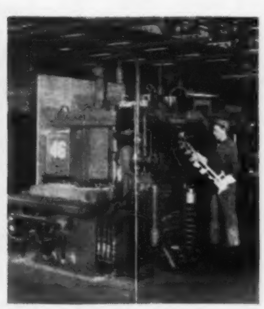
LAKE ERIE ENGINEERING CORP.
General Offices and Plant:
470 Woodward Avenue, Buffalo 17, N. Y.
District Offices in New York • Chicago • Detroit
Representatives in Other U.S. Cities and Foreign Countries
HYDRAULIC PRESSES • DIE CASTING MACHINES
EXTRUSION PRESSES



New developments in steel forging have greatly expanded its application.



Non-ferrous extrusion installations now embrace titanium, magnesium and newer metals.



Production rates of die cast aluminum and zinc parts have been upped 20% to 30%

"MOVE the METAL" is NOT NEW…

When this advertisement first appeared several years ago, it apparently sparked the current recognition of the "Move Metal" idea. Today the practice is widely accepted, acclaimed and growing. As the leader in the movement, Lake Erie will gladly share its experience with you.

LAKE ERIE®

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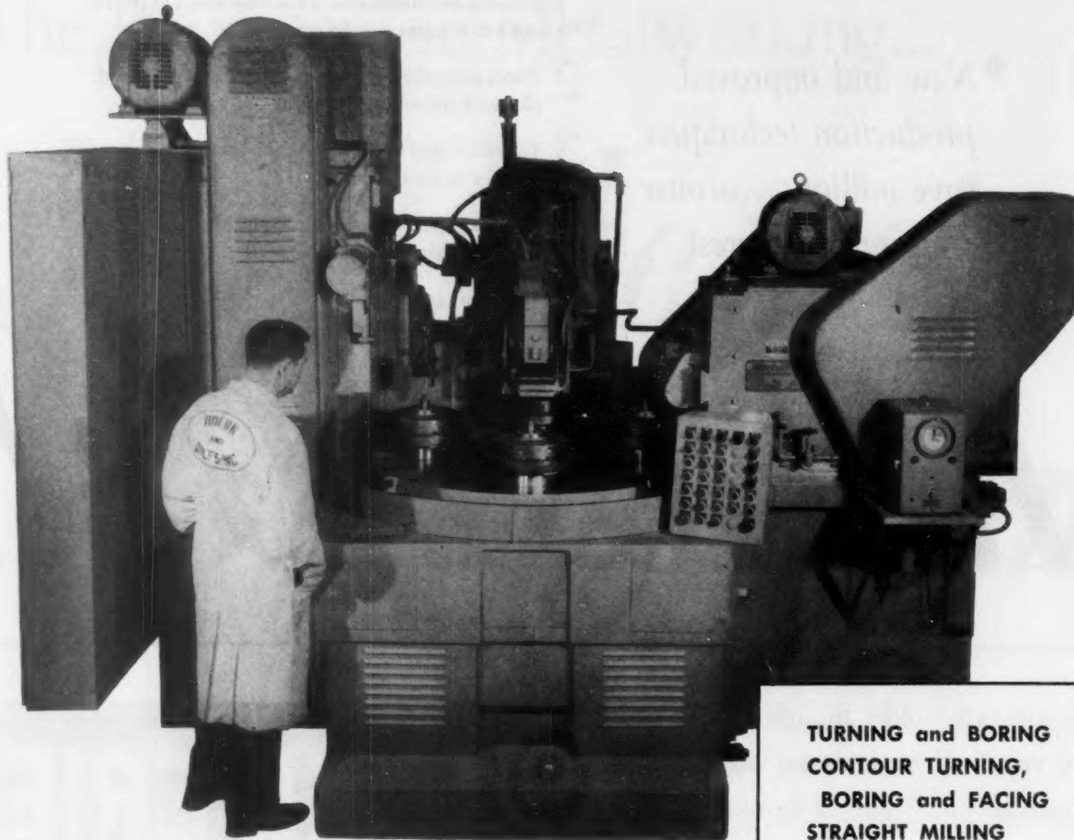

TURNING and BORING
CONTOUR TURNING,
BORING and FACING
STRAIGHT MILLING
CONTOUR MILLING
PLANETARY MILLING
I. D. GRINDING
O. D. GRINDING
SURFACE GRINDING
SURFACE HONING

You can combine these finishing operations on one Hoern & Dilts indexing finishing machine →

Indexing Table: Mounted on pre-loaded roller bearings. Index accurate to .0002". By providing adjacent spindles with proper chucking devices, *both ends* of a piece may be put through identical or closely related operations.

Heads: Individually cam-actuated heads, each designed for a specific type of operation which may be performed vertically or horizontally as required. Heads self-contained, with individual electrical, pneumatic and lubricating systems.

Speeds: One over-all speed may be used, or a different speed at each station. Spindles may be stopped and locked in any predetermined position at any station.

Feeds: Individually adjustable for each head.

Grinding Operations: Wheels dressed and compensated during index.

Automatic Gauging and feedback adjustment available at all stations.

A Hoern & Dilts Indexing Finishing Machine handles with *one* chucking and one operator, the operations ordinarily performed by several operators using completely different types of equipment.

This advanced approach to increased, more accurate production is accomplished by arranging a variety of self-contained heads around a central indexing table in which the spindles are mounted. Since all the operations are performed with a single chucking, all the proper relationships are maintained.

Hoern & Dilts engineers will welcome the opportunity to cooperate with you on any high production finishing operation.

HOERN & DILTS DIVISION

The New Britain Machine Company
Saginaw, Michigan

OTHER NEW BRITAIN MACHINE TOOL DIVISIONS:

New Britain-Gridley Machine Division
New Britain, Connecticut
Automatic Bar and Chucking Machines
Precision Boring Machines and
New Britain +GF+ Turning Lathes

Lucas Machine Division
Cleveland, Ohio
Precision Horizontal Boring,
Drilling and Milling Machines

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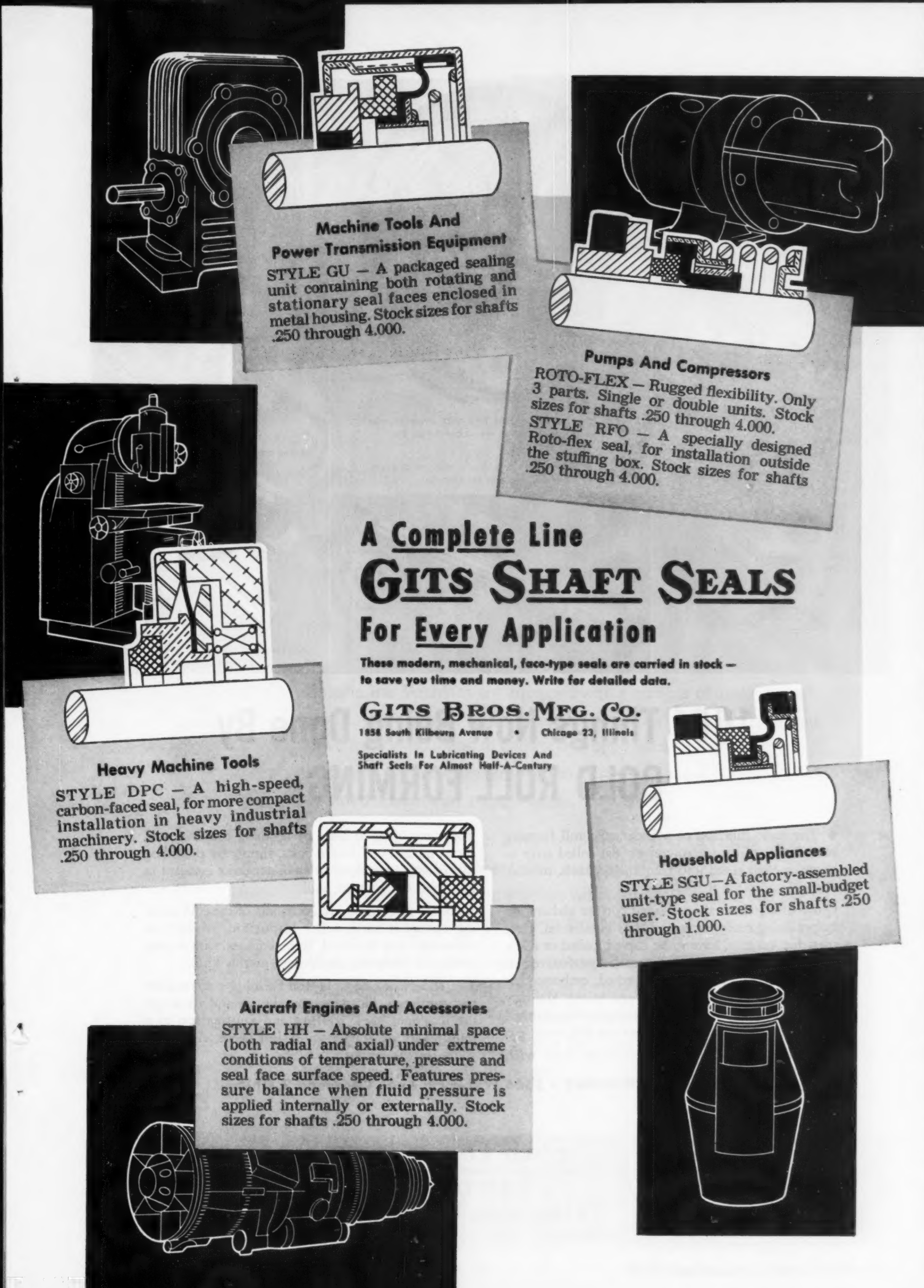
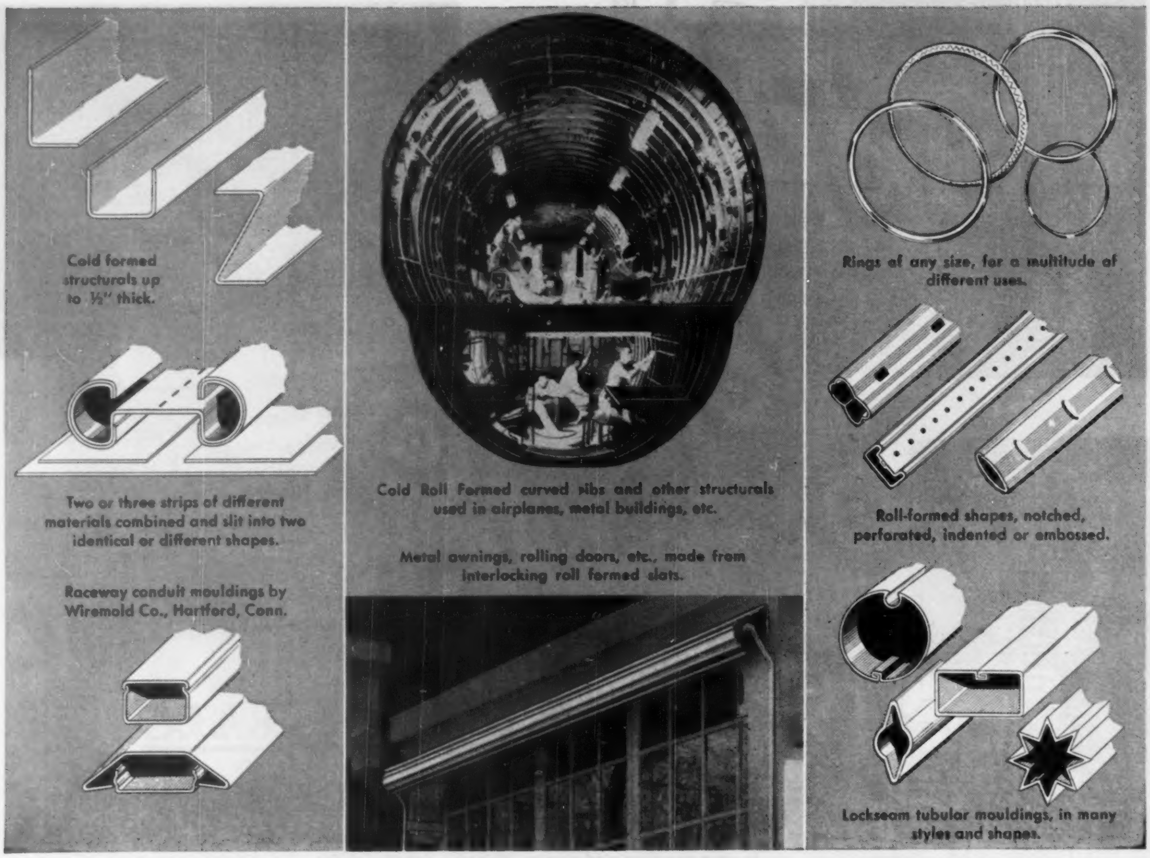


Machine Tools And Power Transmission Equipment
STYLE GU — A packaged sealing unit containing both rotating and stationary seal faces enclosed in metal housing. Stock sizes for shafts .250 through 4.000.
Pumps And Compressors
ROTO-FLEX — Rugged flexibility. Only 3 parts. Single or double units. Stock sizes for shafts .250 through 4.000.
STYLE RFO — A specially designed Roto-flex seal, for installation outside the stuffing box. Stock sizes for shafts .250 through 4.000.
A Complete Line
GITS SHAFT SEALS
For Every Application
These modern, mechanical, face-type seals are carried in stock — to save you time and money. Write for detailed data.
GITS BROS. MFG. CO.
1858 South Kilbourn Avenue • Chicago 23, Illinois
Specialists In Lubricating Devices And Shaft Seals For Almost Half-A-Century
Heavy Machine Tools
STYLE DPC — A high-speed, carbon-faced seal, for more compact installation in heavy industrial machinery. Stock sizes for shafts .250 through 4.000.
Household Appliances
STYLE SGU—A factory-assembled unit-type seal for the small-budget user. Stock sizes for shafts .250 through 1.000.
Aircraft Engines And Accessories
STYLE HH — Absolute minimal space (both radial and axial) under extreme conditions of temperature, pressure and seal face surface speed. Features pressure balance when fluid pressure is applied internally or externally. Stock sizes for shafts .250 through 4.000.



1001 Things Now Being Done By COLD ROLL FORMING

• The basic function of a Yoder cold roll forming machine is, of course, to convert flat rolled strip or sheets at high speed into mouldings, panels, tubular, channel and other shapes.

Quite often, these shapes need further elaboration before being ready for assembly or installation. They may, for instance, have to be curved, coiled or made into rings. Or they may need to be perforated at certain intervals of spacing, notched, embossed, or otherwise finished by additional operations. You may want to combine two or more materials into a finished shape, such as carbon steel with stainless, felt, wood, etc.

These and many other things can be done with Yoder machines at little or no extra cost over and above normal conversion costs, simply by providing special attachments, or by auxiliary units installed in line with the forming mill.

So, to the recognized high economy of the cold forming operation itself, other important production economies may be added. Yoder engineers are at your service in designing equipment of this kind.

The Yoder Book on Cold Roll Forming is a complete text, profusely illustrated, on the art and its scope, the machines, their tooling and application to a multiplicity of mass production needs. A copy is yours for the asking.

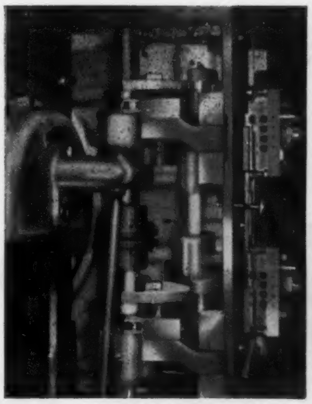
THE YODER COMPANY • 5504 Walworth Ave., Cleveland 2, Ohio

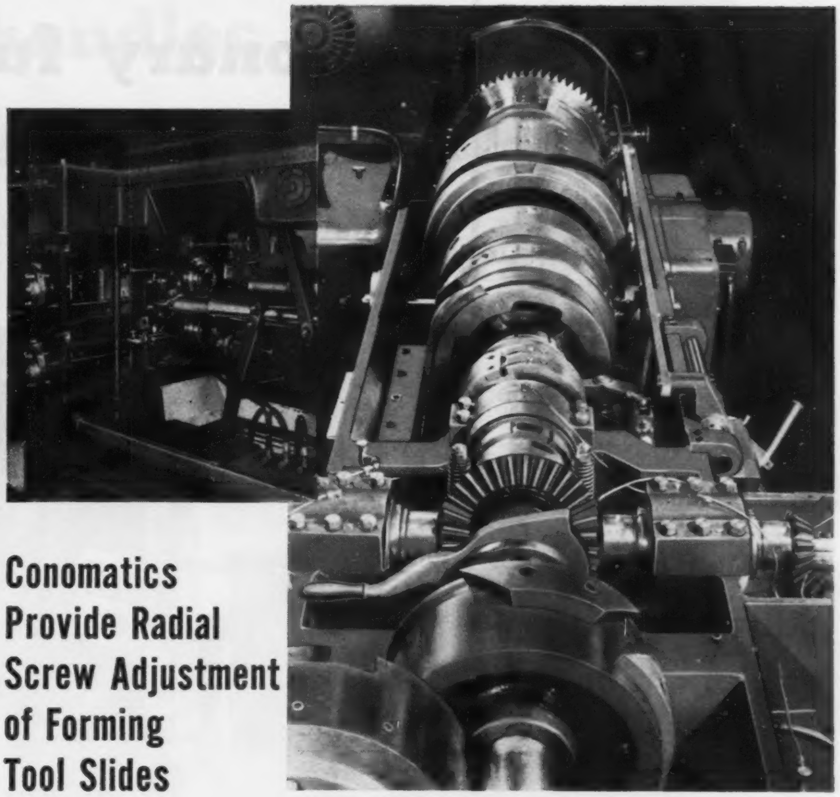
ENGINEERING YODER MANUFACTURING

COLD ROLL FORMING MACHINES

ROTARY SLITTING LINES

PIPE AND TUBE MILLS—Electric Weld



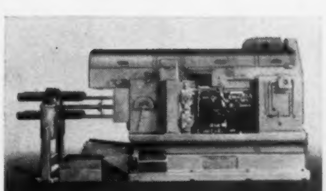


Conomatics Provide Radial Screw Adjustment of Forming Tool Slides

- Models $2\frac{5}{8}$" LA, $3\frac{1}{2}$" AD, 5" KL, and $5\frac{1}{4}$" KR Conomatic Four Spindle Bar Machines are equipped with a number of quick job-change features. One of these is the all-position end attachment drive for the mounting of endworking opposed spindles in all positions, with independent feed to as many as three opposed spindles on a single setup.

Another feature that is of considerable importance in tooling up is the radial screw adjustment of all sideworking slides. Trial cuts may be taken to correct diameters with form tools without changing the clamped positions of the form tool holders.

All Conomatic quick changeover models are equipped with dial adjustment of the working stroke of all tool carrying slides. Besides the Four Spindle machines there are three quick change Six Spindle models in $\frac{9}{16}$", 1" and $1\frac{5}{8}$" sizes.
Write, wire, or phone for literature.

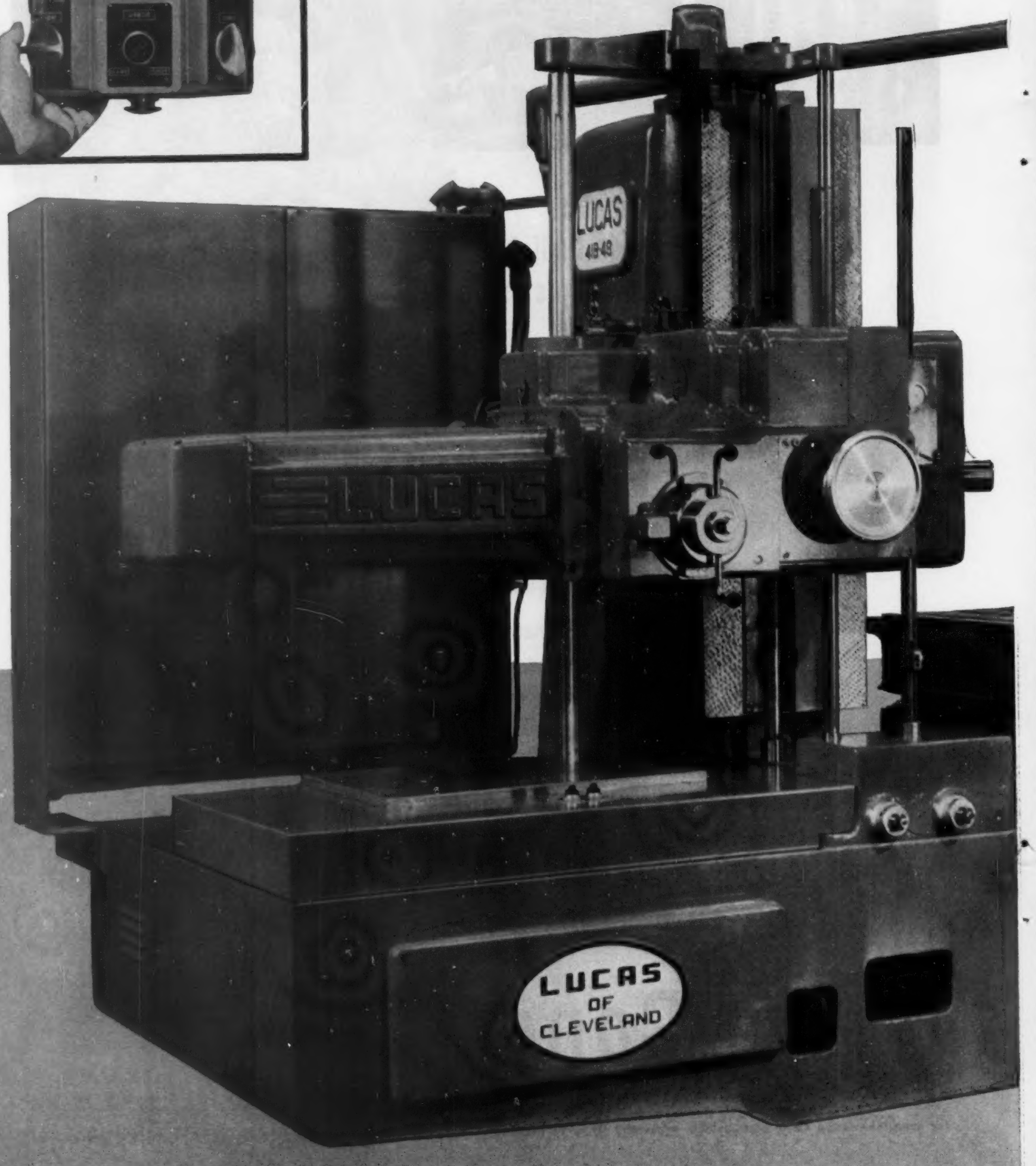


Conomatic

CONE AUTOMATIC MACHINE COMPANY, INC., WINDSOR, VT., U. S. A.

For more information fill in page number on Inquiry Card, on page 225

revolutionary full-control



pendant handles all motions of the Lucas — faster

The operator's time and energy are saved for productive work through the use of the new LUCAS conveniently positioned full-control pendant. At the operator's finger tips it controls all the motions of the head, table, saddle, spindle, engagement of feed, engagement of rapid traverse and changing of feeds and speeds.

This optional feature, in combination with Automatic Power Positioning, greatly simplifies operation in both tool room and repetitive production operations. To get the most from your Horizontal Boring Machine investment, be sure to investigate LUCAS, the specialist in these machines for fifty-six years.

The Lucas line now includes 24 models in 3", 4", 5" and 6" spindle sizes for the most economical matching of your particular requirements. All models available in your choice of manual or full electrical controls.

Model 41B-48 Lucas Precision Horizontal Boring, Drilling & Milling Machine

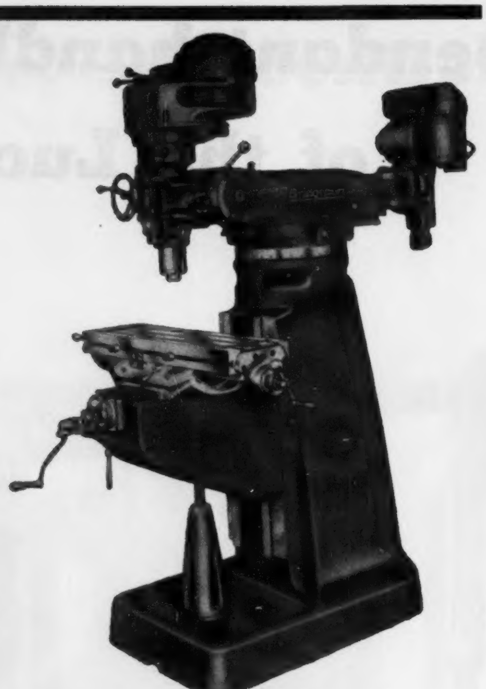
LUCAS OF CLEVELAND

A DIVISION OF
THE NEW BRITAIN MACHINE COMPANY

ATTACHMENTS *for* *Bridgeport*

TURRET MILLING MACHINES

add outstanding versatility to a machine already versatile



WHEN you buy the BRIDGEPORT TURRET MILLING MACHINE, you buy more than a conventional vertical milling machine. You actually buy and get a machine of a type conceived, created and developed by Bridgeport. In addition to the turret principle originated by Bridgeport, attachments have been designed which add a great many features to the machine so that its basic purpose for milling, drilling, boring and shaping has been extended to include also cherrying, right angle milling as well as copying with the Bridgeport Hydraulic True Trace Combination.

One of the outstanding advantages of this machine is that you can buy this basic machine with some or all of these attachments or add them later whenever the need arises for the handling of specific operations.

Investigation of BRIDGEPORT TURRET MILLING MACHINES and their many attachments is always in order.

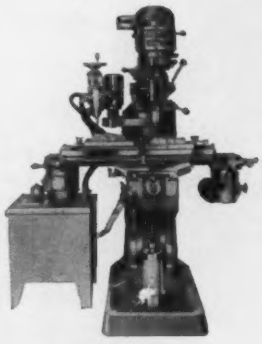
RIGHT ANGLE ATTACHMENTS

(Above) Heavy Duty . . . for milling and drilling at right angles; fits both Master and 1 HP Bridgeport Heads.

(Above) Light Duty . . . for right angle milling and drilling narrow, deep molds and cavities.

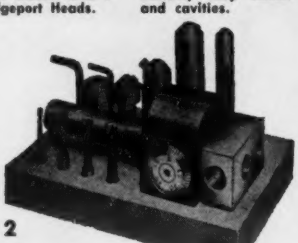
CHERRYING ATTACHMENT

Makes possible production of convex and concave shapes. Ideal for producing drop forge dies, molds, cavities.



TRUE TRACE COMBINATION

The Bridgeport True Trace Combination will give excellent performance and save endless hours when copying irregular dies and molds.



NO. 2 BORING HEAD

Boring Tools and Holder provide means for boring holes up to 6" diameter; available for use on Bridgeport 1 HP Milling, Drilling and Boring Attachment.

***Bridgeport* MACHINES, INC.**

Bridgeport, Connecticut

Manufacturers of High Speed Milling Attachments and Turret Milling Machines

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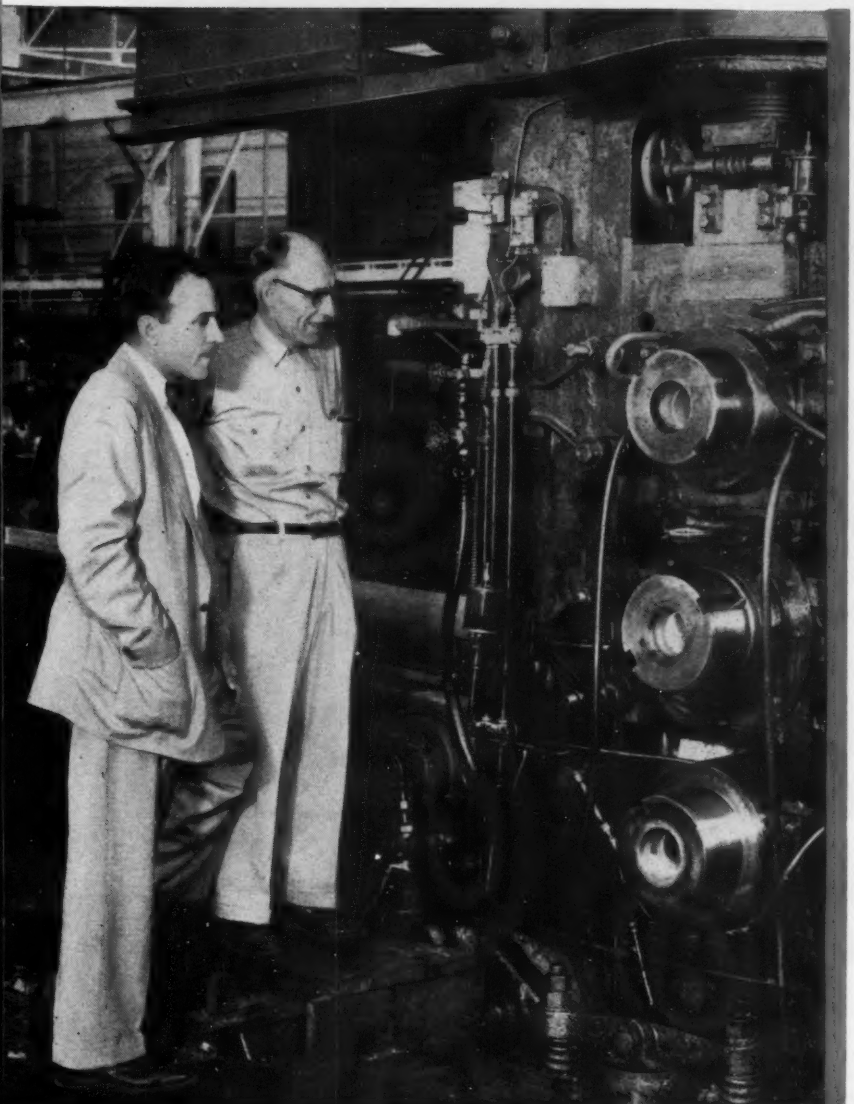
Sick slab roll recovers fast with application of STANOGEAR Compound



Eugene Ewald (right), Mill Foreman, and Marshall Fox, Standard Oil lubrication specialist, inspect slab roll. STANOGEAR Compound helped solve lubrication problem on roll neck bearings.

Marshall Fox who proposed switch to STANOGEAR with resultant improved operation, is experienced in providing such technical service. Marsh has a Mechanical Engineering degree from Purdue to qualify him for this work. In addition, he has completed Standard's course for sales engineers. This experience and training, customers find, pay off *for them.*

A slab roll at Matthiessen & Hegeler Zinc Company, La Salle, Illinois, was sick. It suffered from repeated roll neck bearing failures. Bearing temperatures couldn't be controlled. A consultant was summoned—Marshall J. Fox, Standard Oil lubrication specialist. His diagnosis and remedy: Install STANOGEAR Compound and equip the machine with a central pressure system for application. Recommendations were followed. Result: No bearing failures, due to faulty lubrication, since. Maintenance costs reduced. Time lost through breakdowns slashed.

This was a condition made to order for STANOGEAR to remedy. And Matthiessen & Hegeler knew there was a man at hand who could suggest what should be done. It's another demonstration of what this unbeatable combination can do when put to work:

1. **Standard Oil lubrication specialists capable of giving technical help.**
2. **Top quality products *that deliver results required.***

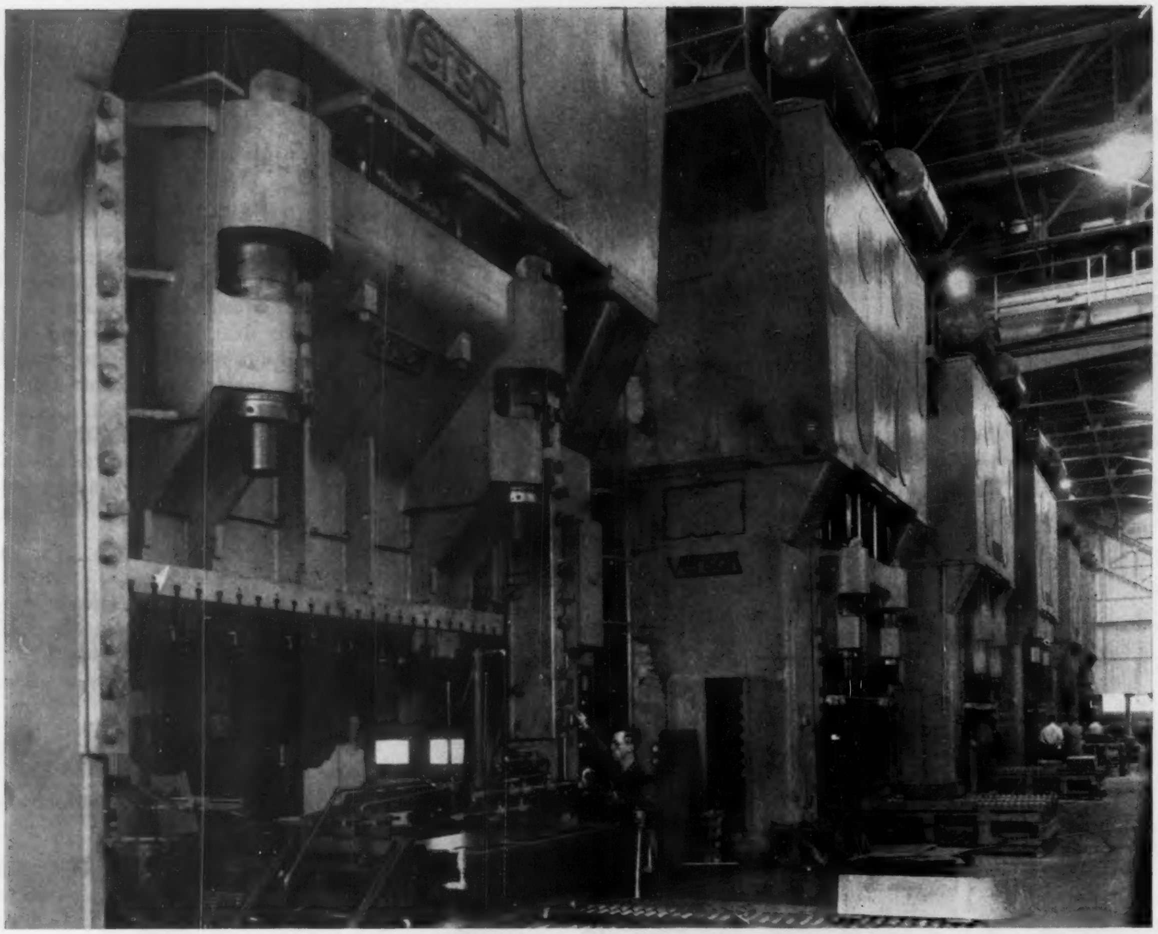
STANOGEAR Compounds contain special additives making them suitable for applications where heavy loads cause welding, seizure or scoring.

In the Midwest and Rocky Mountain states, a Standard Oil lubrication specialist in your nearby Standard Oil office will gladly give you more information about STANOGEAR. Call him. Or contact Standard Oil Company, 910 So. Michigan Avenue, Chicago 80, Ill.

STANDARD

STANDARD OIL COMPANY

(Indiana)



Could you compete with a press room like this?

the RISING COST of Obsolescence

Obsolescence is the creeping malignancy of manufacturing. The longer it goes unchecked, the weaker its victim becomes, the more costly the cure. Recent developments by Verson in the press forming of metals have obsoleted processes that were the most efficient available a few short years ago. Check your plant for symptoms.

Unless you're in the automotive industry you probably won't have to compete with this particular press room. But, if you make anything that is pressed out of metal you probably will have to compete with a press room equally modern and efficient.

What does this mean to you?

Competition that reaches its culmination in the market place often begins in the shop. Here is where a large measure of your competitive price position is determined. Here is where profits can be made—or lost.

What's the answer?

The answer is a *planned* program of modernization of your production processes. Sit down with your suppliers and develop a program for systematically replacing inefficient, obsolete methods. Generally, you need not replace it all at once. Very often one machine at a time can be replaced, just so it is done to a well developed plan.

In your press room, sit down with Verson. Put Verson experience in the development of production processes to work for you. Utilize the know-how that results from Verson's approach to press building—"Anyone can build a press, Verson builds production processes". Write or phone.

A Verson Press for every job from 60 tons up.

TRADE Verson MARK

ORIGINATORS AND PIONEERS OF ALLSTEEL STAMPING PRESS CONSTRUCTION

VERSON ALLSTEEL PRESS CO.

9309 S. KENWOOD AVENUE, CHICAGO 19, ILLINOIS • SO. LAMAR AT LEDBETTER DRIVE, DALLAS, TEXAS

MECHANICAL AND HYDRAULIC PRESSES AND PRESS BRAKES • TRANSMAT PRESSES • TOOLING • DIE CUSHIONS • VERSON-WHEELON HYDRAULIC PRESSES

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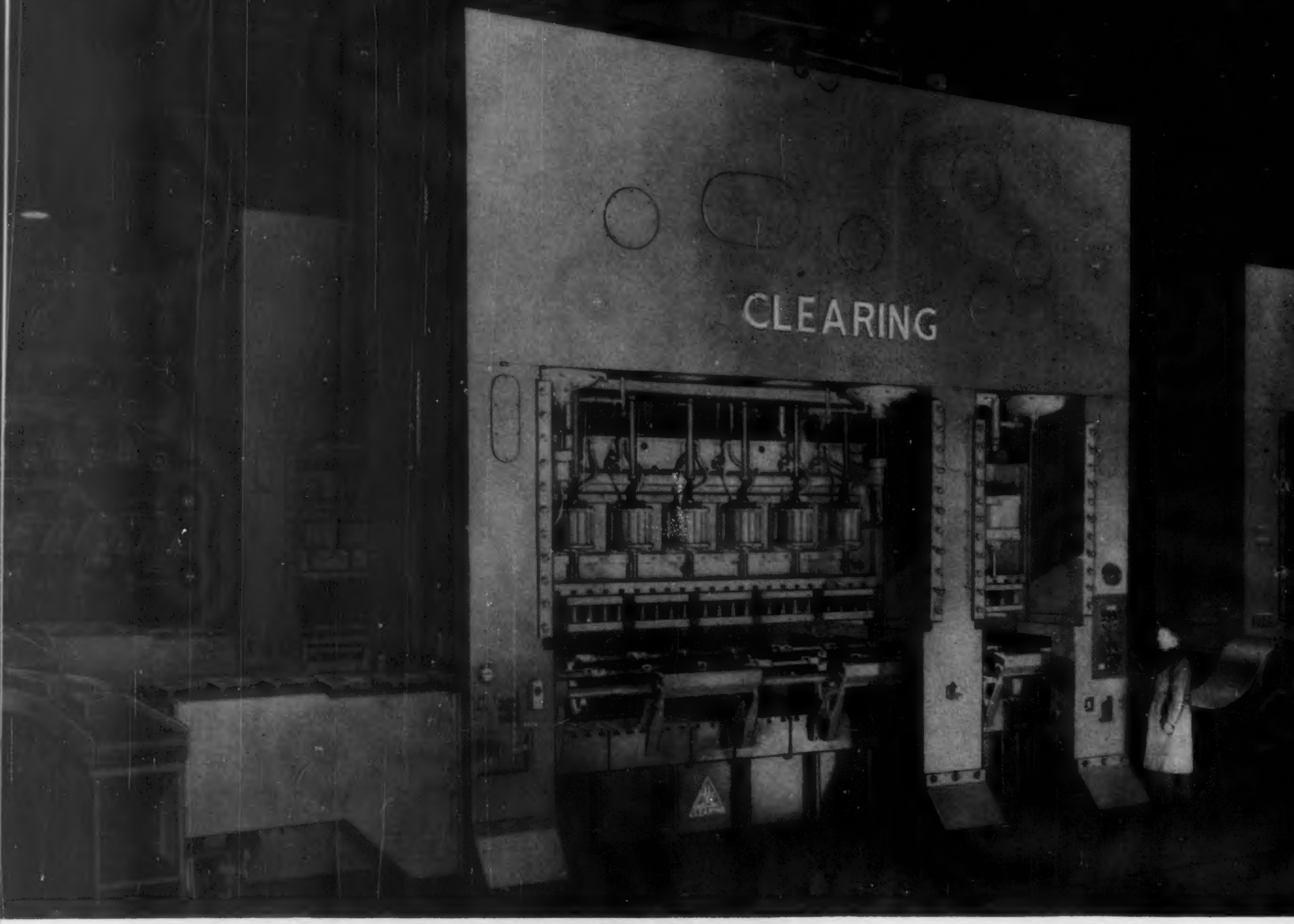
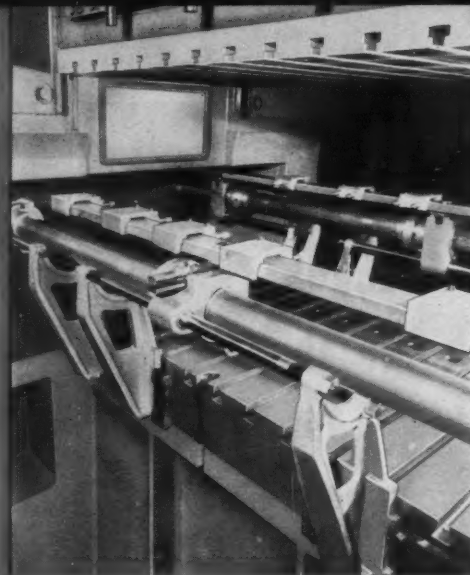
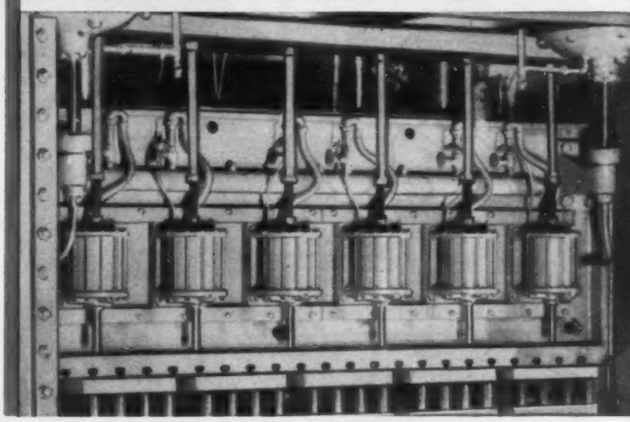

CLEARING



ADJUSTABLE FEED

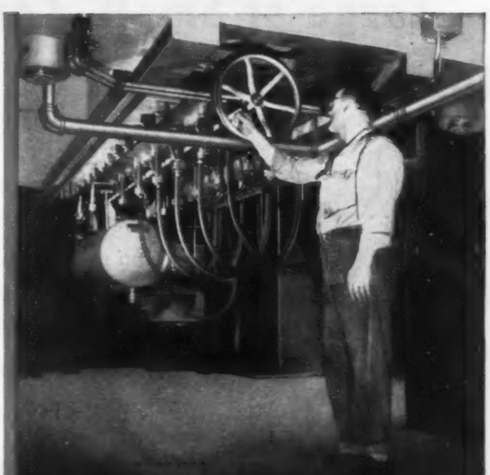
Both the length of feed stroke and the spacing of the transfer fingers are easily adjustable on a Clearing Transflex Press. Fingers are quickly interchangeable to grip a variety of contours and hold a number of sizes.



ADJUSTABLE KNOCKOUTS

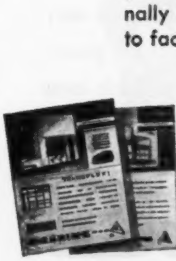
The Transflex knockout arrangement utilizes a series of air cylinders to eject pieceparts at each die station. Cylinders are mounted on ways and are easily moved right and left to conform to changed die arrangements. Positive mechanical knockouts provided as a safety factor are also mounted in tracks, making them fully adjustable.

uses TRANSFLEX



ADJUSTABLE CUSHIONS

The man shown at right is turning the cushion adjusting wheel in order to re-align the cushions to the right or left in a Transflex press. Cushions are self-contained and internally guided, and are mounted on gibways to facilitate adjustment.



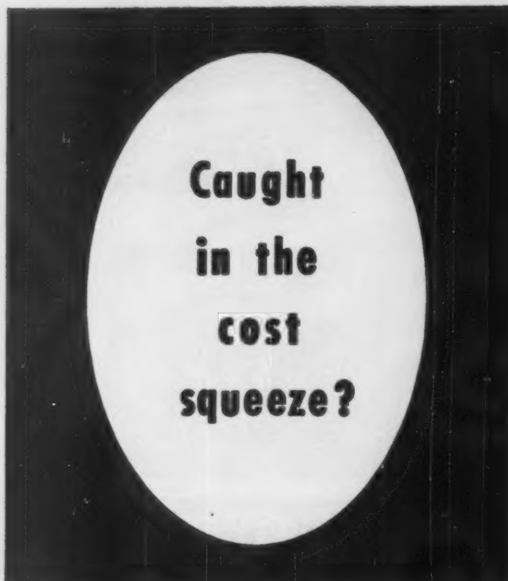
Bulletins on Transflex presses will be sent promptly at your request. Write for these fact-filled bulletins today.

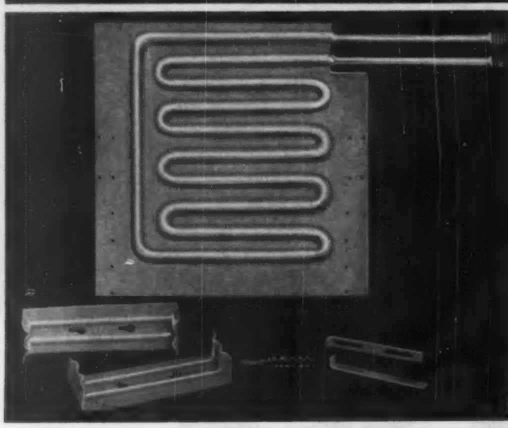
THE WAY TO EFFICIENT MASS PRODUCTION

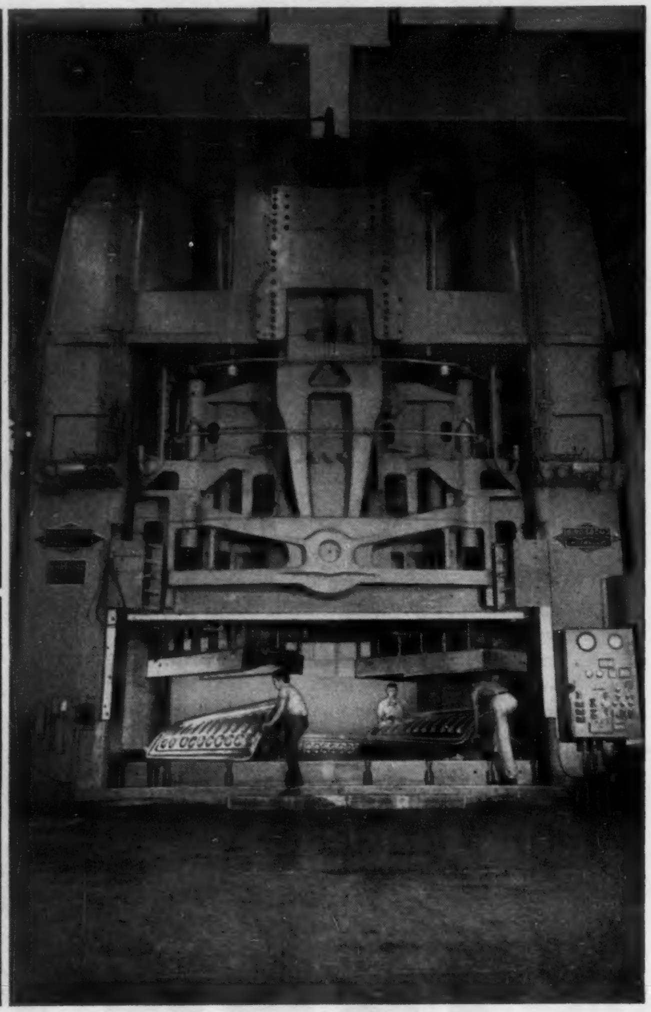
CMC CLEARING

Division of U. S. INDUSTRIES, Inc.

Hamilton Plant, Hamilton, Ohio







Large or Small, Complex or Simple—
Stamped Parts Can Be Produced for Less . . .

DESIGNERS AND BUILDERS OF:

STEEL MILL MACHINERY
HYDRAULIC PRESSES
(Metalworking and Extrusion)
CRUSHING MACHINERY
SPECIAL MACHINERY
STEEL CASTINGS
Weldments "CAST-WELD" Design
ROLLS: Steel, Alloy Iron, Alloy Steel

● . . . and the key is Birdsboro's specialized Hydraulic Press design. You can get the steady, high output you need to keep production costs down, yet gain new freedom from maintenance problems. And with Birdsboro's advanced engineering outlook, you are assured of the versatility you may need as diversification and new methods change your production plans. Strike now at rising costs. Call in a Birdsboro representative to look over your present press setup. He may have the answers you've been seeking.

HP 29-56

BIRDSBORO

BIRDSBORO STEEL FOUNDRY & MACHINE CO., Main Offices in Birdsboro, Pa. District Office: Pittsburgh, Pa.

New York Office: Engineering Supervision Co., 120 West 42nd Street, New York 36, N.Y.

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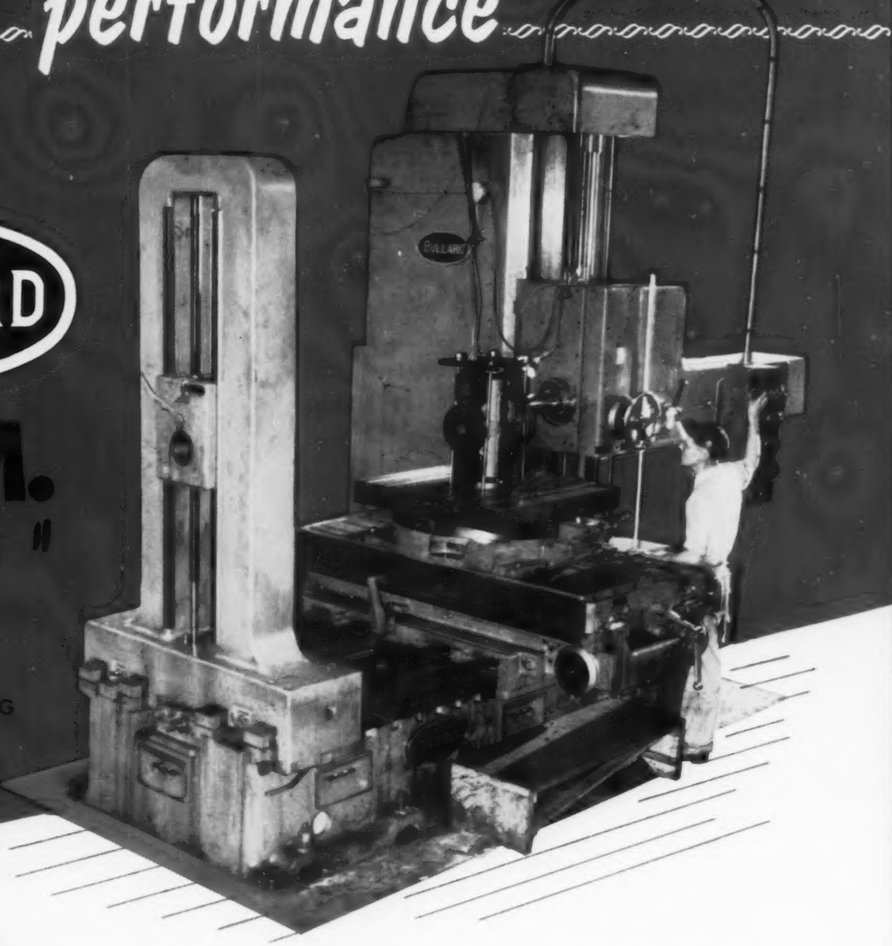
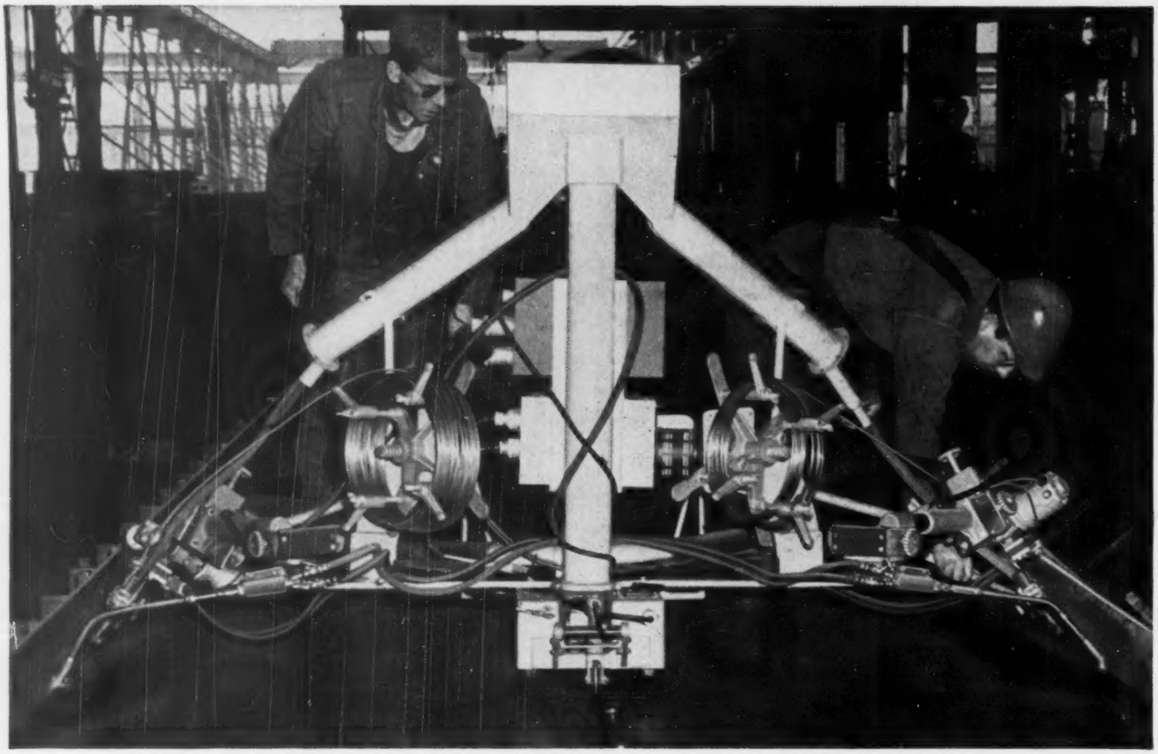
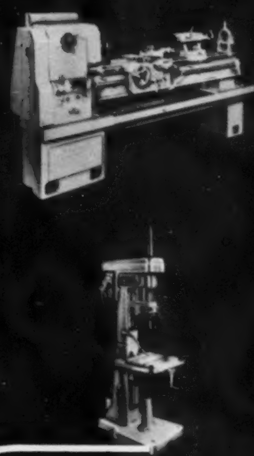




· UNIONMELT *welding simplifies and speeds fabrication of giant steel beams.*

For more information fill in page number on Inquiry Card, on page 225



ELECTRICAL EQUIPMENT MAKERS know the production penalties of obsolete machine tools. They know, too, that half their 43,000 drilling machines and 45,000 lathes are over 10 years old.* Replacement and modernization has already started in this industry. It needs starting all over the country, for half our machine tools were built to World War II standards. Our enemies know this and so do your biggest competitors.

Yet modernization is quick and inexpensive with "Standard Machine Tools" developed against fresh, new concepts of appearance, function and accuracy. To this end, Cincinnati Lathes and Drills are built to do much of your jobbing, tooling, maintenance and light production work at tremendous savings. Write for complete catalog information. Cincinnati Lathe and Tool Co., 3247 Disney, Cincinnati 9, Ohio.

*Figures from American Machinist's Seventh Inventory

center on... **cincinnati lathes and drills**

Machines shown are Cincinnati's new 16" Sliding Head Drill and 15" Tray-Top Lathe.

PRINTED IN U.S.A.

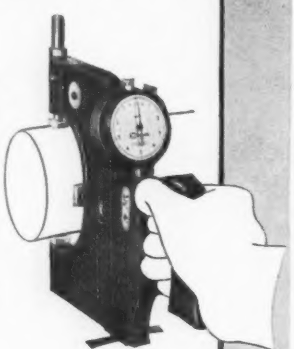
Choose the Gage that's RIGHT for YOUR job!

There's a STANDARD® Dial Snap Gage That Fits Your Particular Requirements . . . Precisely

Paralloc®

STANDARD's Paralloc anvil locking mechanism maintains parallelism of anvil faces to an unusually high degree of accuracy

L TYPE . . .



For tough, long run jobs or those involving deep, narrow places

Gages close to shoulders

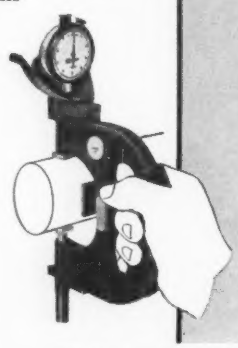
Flat anvils, faced with tungsten carbide, ideal for close tolerances

Indicator fully guarded, conveniently placed for easy reading

Sizes up to 14″
Wide range of indicators

D TYPE . . .

With Paralloc anvil locking mechanism and tungsten carbide faced flat anvils



Lower initial cost

Gages close to shoulders

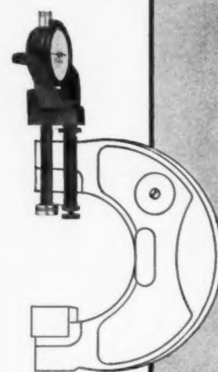
Suitable for long runs where side clearance and forward position of indicator are not important factors

Sizes up to 8″

Wide range of indicators

Dializers®

STANDARD Dializers provide an economical, effective means for converting your AGD Adjustable Limit Snap Gages to Dial Snap Gages.



Fit your present AGD frames of any make, or, if desired, we can supply frames up to 26⅝″

Dializers can be easily installed and transferred from one frame to another

Has radiused contact

The easy way to gain greater efficiency with greater economy

SF SERIES . . .

Designed for situations where low cost is an important factor and requirements do not suggest need for Paralloc models.

Light weight, sturdy, special aluminum frame

Fitted with Dializer

One contact radiused

Long range of adjustment

Easily adaptable to many jobs

Sizes to 13½″

Write for Special Dial Snap Gage Bulletin

STANDARD GAGE COMPANY, INC.

MEASURING INSTRUMENTS FOR PRECISION INDUSTRY

132 PARKER AVE. POUGHKEEPSIE, N. Y.

STANDARD® Gages

For more information fill in page number on Inquiry Card, on page 225

How CHERRY-BURRELL
reduces their cost savings opportunities to careful analysis . . .

OPERATIONAL ANALYSIS OF PROPOSED CAPITAL EXPENDITURE

Serial No. ________

Division: Cedar Rapids — Subject: Special Equipment to spin & polish dished heads — Date: 3-26-54

Line			
1	Purpose of Expenditure, and Explanation of Need: Design & construct Equip.		
2	To spin dished storage tank heads and equipment to polish.		
3	Needed to reduce cost of these items and increase profits		
4	Data on Present Facility or Equip.	Data on Proposed Facility or Equip.	
5	Description ________	Description: Vertical head spinning & Polishing	
6	Machine No. ________	Make: Equipment to be made by Cherry-Burrell	
7	Date purchased ________	Total Installed cost: 19,800	
8	Installed cost ________	Est. Terminal Salvage Value: 300	
9	Present Salvage Value ________	Net Loss of Salvage Value: 19,500	
10	Est. Salvage Value in one Yr. ____	Estimated Service Life: 10	
11	Next Year Loss on Salvage Value __	Loss of Value per Year: 1950	
12	Propose to - Trade ☐ Sell ☐ Keep ☐		
13	Installed Cost of Proposed Equipment	19,500	
14	Present Salvage Value of Present Equip.		
15	Net Additional Investment	19,500	
		Cost for Present Equipment	**Cost for Proposed Equip.**
16	Operational Advantages		
	Purchase heads Spin & Polished	37,770	
A	Freight costs on purchased heads	6,918	
	Excess inventory costs because of purchasing heads	960	
B	Operating Cost Advantages		
	Direct Labor, 4442 Hrs. @ $2.00		8,884
	Indirect Labor, 4442 @ 1/2 $1.98 - .99		4,395
	Fringe labor costs 4442 @ .64		2,840
	Ordinary maintenance 4442 @ .15		665
	Tool costs & supplies 4442 @ .55		2,440
	Defective material 4442 @ .20		887
	Power consumption: 20HP x 1.2 x 44 x .016 x 99.8 = 168.5; 5 HP x 1.2 x 44 x .016 x 34.84 = 146		315
	Property taxes & Insurance 1½ 19,500		292
	Loss on salvage value		1,950
C	Total	44,648	22,668
17	Net Operating Advantage of (Present) (Proposed) Equipment	21,980	
18	Rate of Return on Additional Investment	-112%	

Statement by
JOHN G. CHERRY
President
CHERRY-BURRELL CORP.
CHICAGO, ILLINOIS

"Proper and timely replacement or expansion of capital assets is the backbone of profitable operation of any business. Cherry-Burrell, therefore, has definite written policies and standards which are designed to make the most profitable use of capital funds available. Competing demands for these funds are judged, basically, on the basis of MAPI formula. Every request for a capital expenditure over a rather small minimum must be accompanied by such an analysis. These analyses are made, furthermore, at periodic intervals on all capital equipment to determine whether that particular unit could profitably be replaced."

*** GAIN from replacement by the Cherry-Burrell Corporation formula is . . . after required interest or return on the new investment . . . after full allowance (by the formula) for future obsolescence of the new equipment.**

ROCKFORD INSERT GROUP

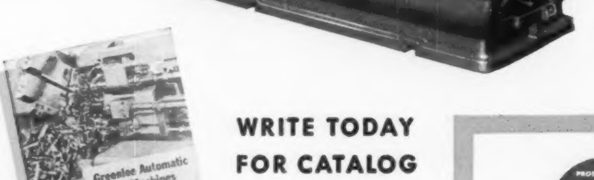
December, 1956

Keep Gathering Metal-Working Production Ideas . . . Be Well Informed When the Time for Replacement Arrives . . . . .

1. Simplified cross-slide camming
2. Interchangeable cross-slide tool holders
3. Quick-adjusting stroke mechanism
4. Rapid speed and feed changes
5. Wide-open, easily reached tooling area
6. Built-in threading feed and drive
7. Easily accessible main toolslide holders
8. Stationary type collets changed quickly

eight big reasons why you get *Fast Setups* on GREENLEE BAR AUTOMATICS

In plant after plant countless hours of setup time are saved each year on Greenlee Bar Automatics. Similar savings in time and money can be achieved in your own plant. Greenlee has on-the-job case studies to prove it. Whether your responsibility lies in the field of management . . . production . . . engineering . . . or purchasing you owe it to yourself and your company to call in the Greenlee man. Let him show you why and how faster setups on a Greenlee pay off in greater profits.



PRODUCTION MACHINERY
GREENLEE

4-SPINDLE...6-SPINDLE
SECOND-OPERATION
PNEUMATIC STOCK FEED

WRITE TODAY FOR CATALOG A-405

PRODUCTION MACHINERY
GREENLEE

GREENLEE BROS. & CO.
1875 Mason Avenue
Rockford, Illinois

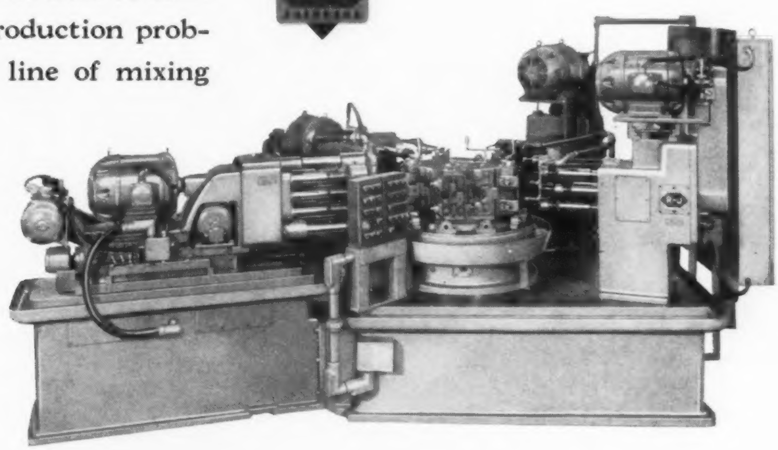
CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

You cannot afford to have obsolete production equipment with which you just "get by." Investigate R-J production equipment—designed for a particular job—to give the maximum in production—to help you make more profits.

REHNBERG-JACOBSON

The machine illustrated was designed and built by R-J for one of America's largest plumbing manufacturers. They came to R-J for a solution to machining and production problems on their line of mixing faucets.

R-J



MACHINES THAT PRODUCE!

Be sure to include R-J when you are considering possible sources of production machines. Our prices and deliveries will interest you. Send your inquiries today to R-J for prompt quotations.

REHNBERG-JACOBSON MANUFACTURING CO., 2135 KISHWAUKEE ST., ROCKFORD, ILLINOIS

DESIGNERS, ENGINEERS, MANUFACTURERS
AND PRODUCTION CONSULTANTS

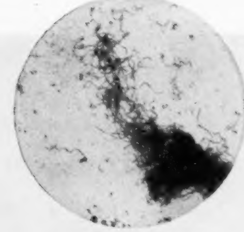
CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**

"Power Designed" for Profitable Production,

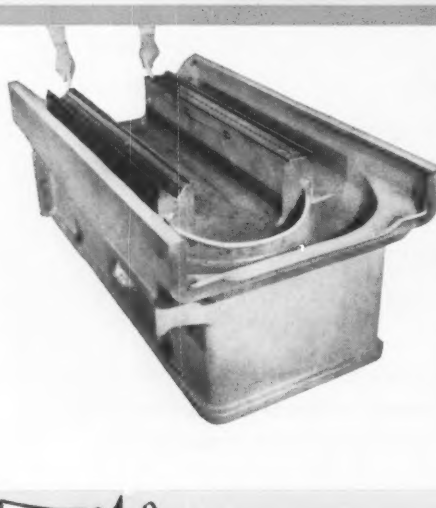
MATTISON VERTICAL SURFACE GRINDERS ARE NOW BETTER THAN EVER!

"POWER DESIGNED" TO INCREASE PROFITS

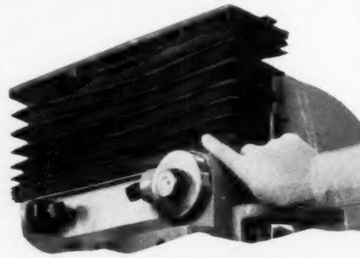
Mattison Grinders are "power designed" to take advantage of today's improved grinding wheels. There's no "rubbing" or heat generation—tremendous pressures are exerted to keep your wheels cool and free-cutting. There's no deflection or vibration because Mattison Grinders are heavy and rigid, from bed to spindle!



Chips from a Mattison No. 36 Vertical Spindle Surface Grinder.



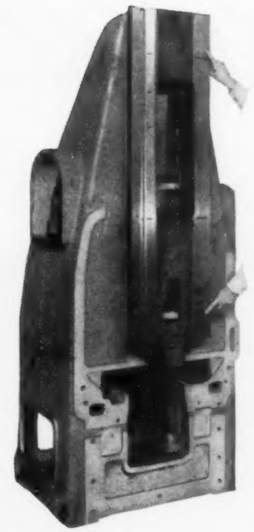
NEW, STRONGER BASE—It's stronger and more rigid . . . with cross-rib and flange construction from finest quality Meehanite metal . . . stress relieved by heat treating. It's not a coolant container. Changes in coolant temperature cannot affect accuracy. Large "V" and flat ways give you more weight-bearing surface for heavy grinding. Table carriage stays in accurate alignment.



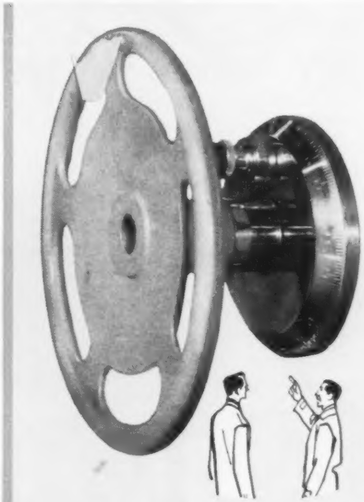
NEW COLUMN WAY GUARDS—Bellows-type guard protects upper "V" and flat ways of column. New telescoping steel guard protects lower ways. Ways of bed are never exposed, whether carriage is *in or out*. Wear and maintenance are reduced, accuracy lasts longer.

CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

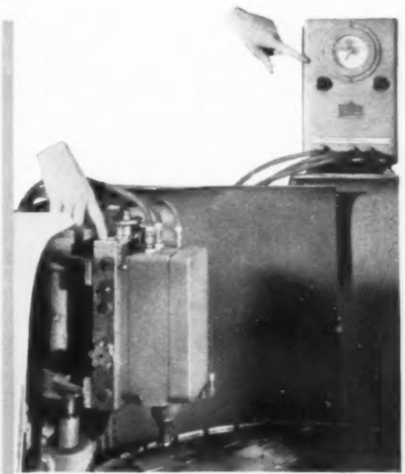
Yes . . . Mattison Vertical Surface Grinders are a better investment today, with extra horsepower and *new* design features to speed your jobs and control your costs! Now you can increase accuracy with Mattison's automatic, continuous feed . . . boost your production with automatic cycling and work sizing . . . increase stock removal with Mattison's heavier, more rigid construction. Measure . . . compare features . . . prove to yourself how these improved grinders reduce machining costs. Ask your Mattison dealer for the complete story.



LARGER, HEAVIER COLUMN—It's bolted and keyed to the base, giving you rigidity equal to one-piece construction. Column is wider and deeper at base height . . . provides extra rigidity for heavier stock removal, finer finish, and greater accuracy. Longer and wider "V" and flat ways provide the rigid support necessary for more powerful spindle motors and accurate feed control.



NEW CONTINUOUS DOWN FEED—With Mattison's new continuous feed, you can *split* the last increment of a ratchet-type feed and increase accuracy. And, there's no limit to the feed rate because of linkage actuation. New, wider feed ranges are profit-boosters on many jobs. Horsepower and wheel capacity are your only limiting factors. It's easy to grind accurate parts!



AUTOMATIC GAUGING SYSTEMS—Mattison offers a choice of automatic sizing systems to increase your production and control quality. Air gauging system continuously measures the work and gives operator visual indication that parts are approaching size. Micro-switch automatic sizer is an electro-mechanical device which continuously measures the work and actuates the automatic cycle at the completion of the grind, after which the machine is ready for the next load.

LARGE CENTER PLATE IN CHUCK—It's easy to service the collector ring and brushholder assembly of a Mattison magnetic chuck through the large 7½ in. center hole. Saves many hours of downtime.

MATTISON MACHINE WORKS

Rockford, Illinois

If it's a flat surface, there's a Mattison to grind it!

MATTISON
HIGH-POWERED PRECISION
GRINDING METHODS

CITY OF MACHINE-TOOL SPECIALISTS ROCKFORD, ILLINOIS, U.S.A.

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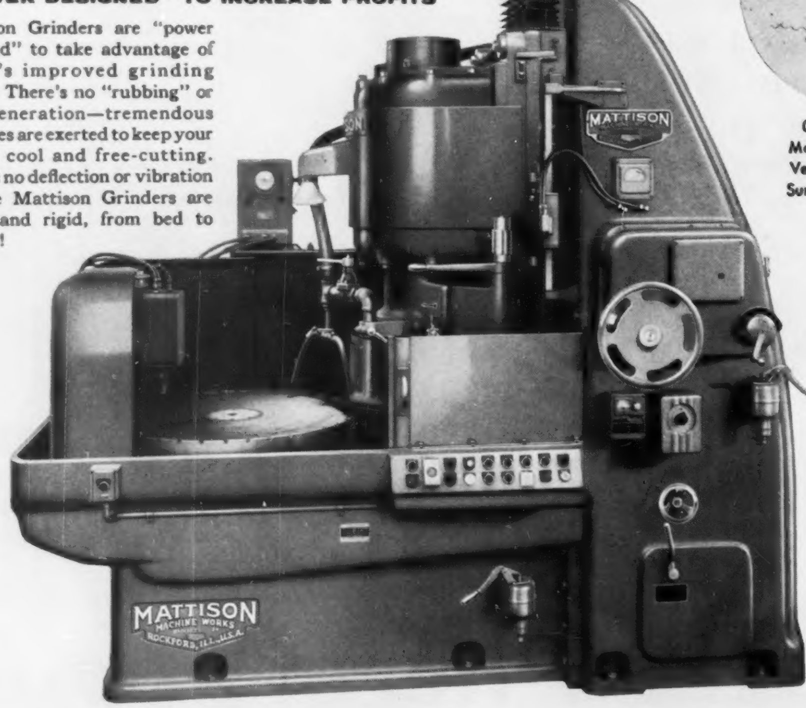

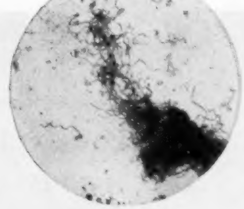

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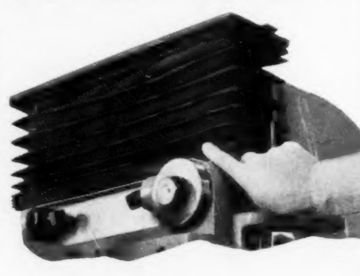

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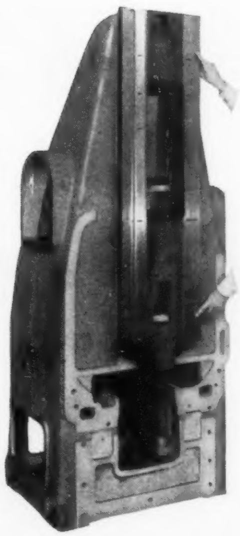

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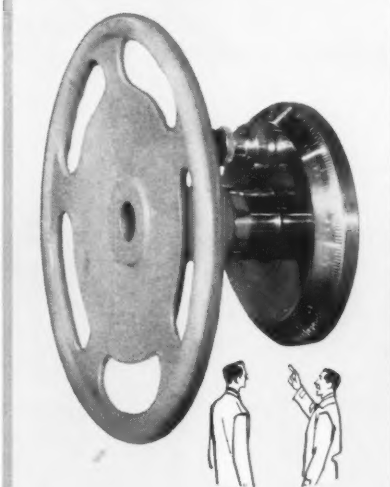

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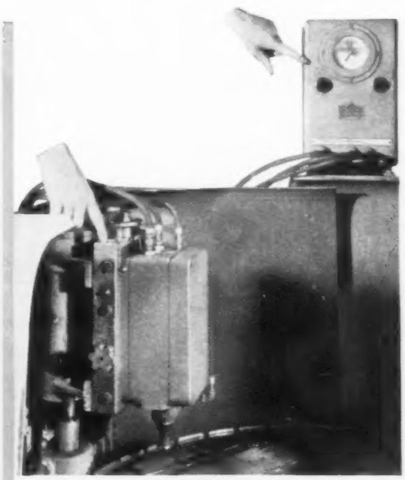

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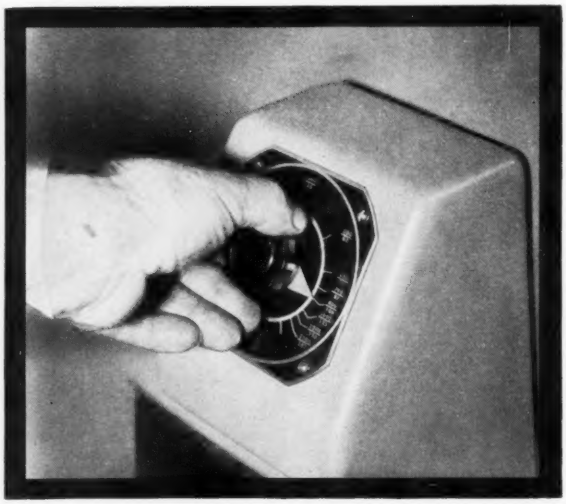
MATTISON
HIGH-POWERED PRECISION
GRINDING METHODS

CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**

Hendey

Now, Hendey stepless speed control makes other types of drives as old-fashioned as overhead belts! Your lathes can't turn a profit while they are coasting to a stop to change speeds. The Hendey speed control unit allows a wide range of stepless speed control and a close control of speed under a changing load. Speeds may be changed smoothly while the spindle is under load. An instantaneous electric dynamic brake is provided for rapid stopping and reversing of the spindle. Starting, stopping, and reversing of the spindle from preset speeds are accomplished smoothly and rapidly. Send for descriptive bulletin.

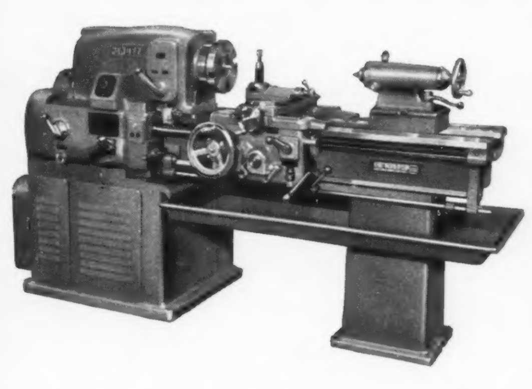


for precision with production, buy Hendey

CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

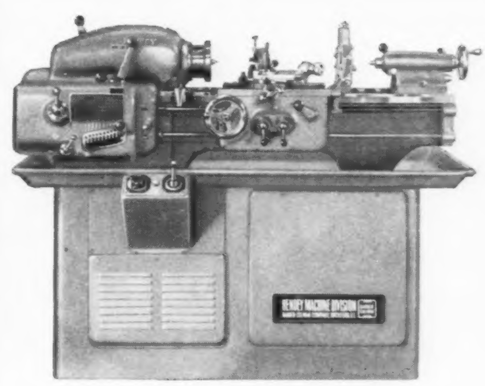
STEPLESS SPEED CONTROL

BOOSTS PROFITS IN YOUR TOOLROOM OR SHOP



General-Purpose Lathe No. 2E, 14 in.

Smooth, vibration-free belt-driven spindle speeds from 15 to 1500 rpm . . . stepless control of speeds permits smooth change even under load . . . dynamic brake on spindle . . . convenient controls . . . preloaded precision spindle bearings.



Tool and Gage-maker Lathe, 9 in. by 24 in.

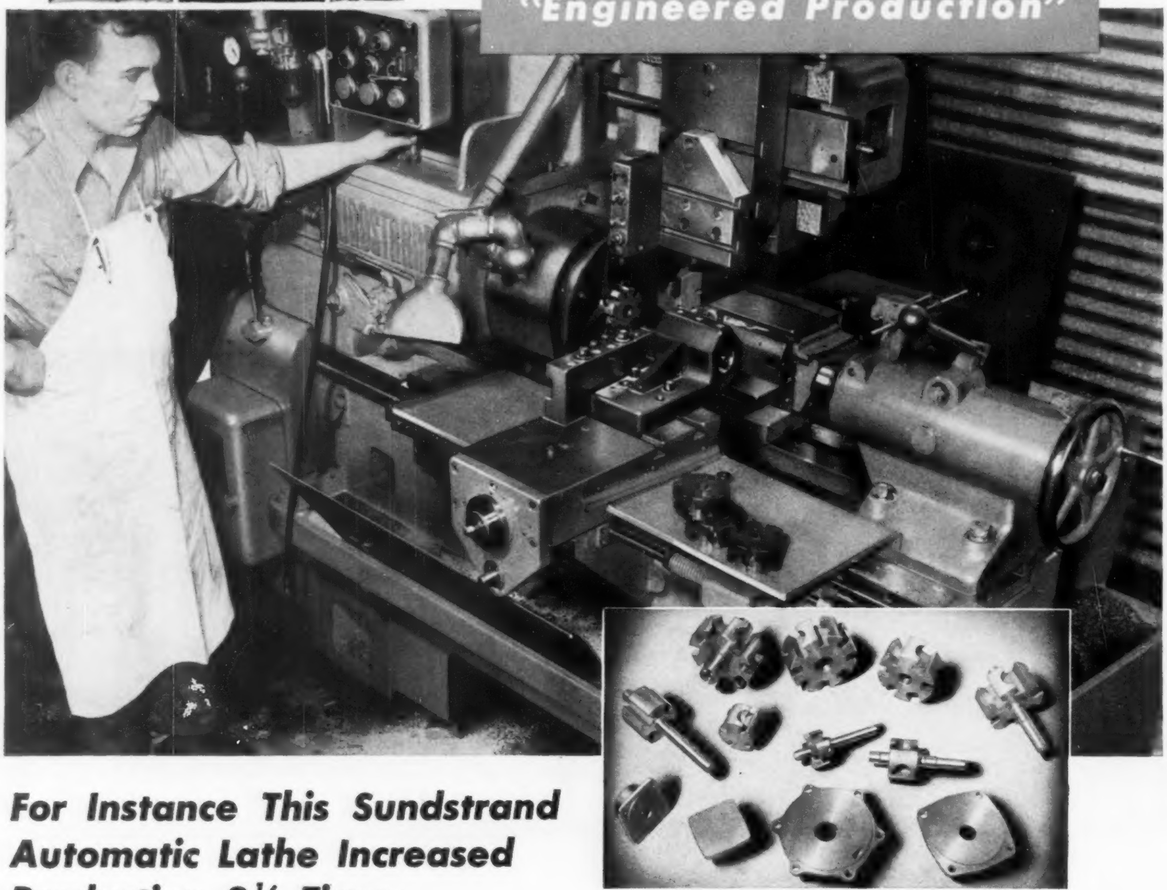
Infinitely variable spindle speeds from 15 to 3000 rpm with magnetic amplifier drive or electronic drive system . . . simplified, convenient controls . . . change speeds smoothly under load . . . dynamic brake stops spindle instantly. . . precision craftsmanship throughout.

Hendey **machine division**
BARBER-COLMAN COMPANY
122 LOOMIS ST., ROCKFORD, ILLINOIS

BARBER COLMAN ®

CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**

Before You Buy ANY Turning Equipment Check What You Get From SUNDSTRAND "Engineered Production"



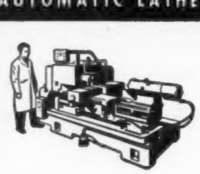
For Instance This Sundstrand Automatic Lathe Increased Production 2½ Times

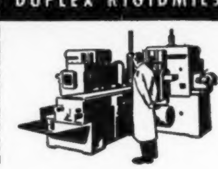
Here's a small lot turning job done on a Sundstrand Model 8A Automatic Lathe. Pump rotors and covers are turned and faced in lot sizes of 100 to 500 pieces. Previously these parts were run on 3 different conventional turning machines using 3 operations. With this Sundstrand Automatic Lathe, the same amount of work is done 2½ times faster.

AUTOMATIC LATHES | SIMPLEX RIGIDMILS | DUPLEX RIGIDMILS

SUNDSTRAND "Engineered Production Service"*

*REG. U.S. PAT. OFF.

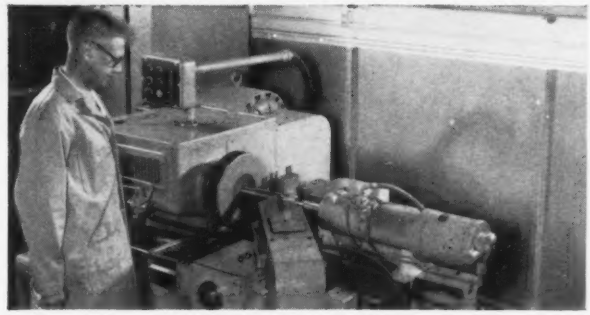




CENTER OF MACHINE-TOOL EXCELLENCE ROCKFORD, ILLINOIS, U.S.A.

WHY SUNDSTRAND CAN OFFER ECONOMICAL SOLUTIONS TO PRACTICALLY ANY TURNING JOB

Many years of designing machine features to increase production and lower costs on all classes of turning problems has provided Sundstrand with the experience to design and build equipment for practically any turning job. A few of the diversified types of Sundstrand tooling and equipment provided for different turning problems are shown on this page.



Tracer Turning

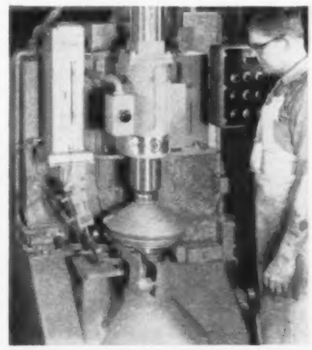
For multi-cycle single point turning of irregular shapes, Sundstrand Automatic Lathes can be provided with a template controlled tracing slide that replaces the regular front carriage. With this tracing slide and controls, ruff, semi-finish and finish cuts can be taken with one turning tool in an automatic cycle. The regular rear slide can be used to square up shoulders, chamfer, etc.

Automatic Tool Resetting

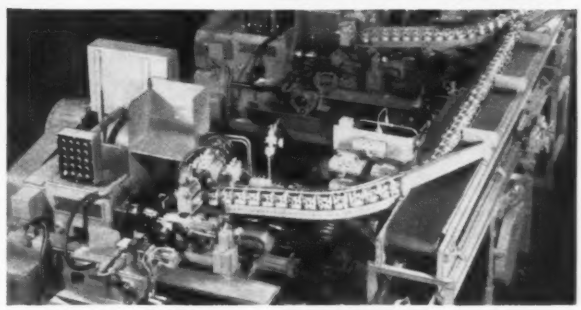
Self compensation for tool wear and automatic replacement of tools worn to a predetermined limit have been built into the Automatic Lathe shown above. Lathe can run approximately an 8 hour shift without attention, except for an occasional check by operator to make sure parts are being delivered to the loading mechanism.

Although the lathe shown above is for turning motor rotors the principle of automatic tool re-setting has been applied to Sundstrand Automatic Lathes for other types of jobs.

Vertical Turning



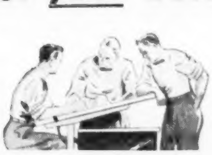
Here's the Sundstrand Vertical Lathe of a simplified basic design easily adapted to production work. Shown here, it bores, polishes and gages the ID of brake drums. Machine is easily arranged for turning, grooving, or tracer applications.



Automatic Loading

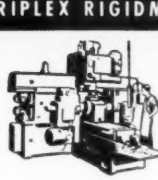
Here's one of the many automatic loading and unloading units designed for Sundstrand Automatic Lathes to handle a specific part. Units of this type simplify machine operation and provide a complete automatic cycle for high production.

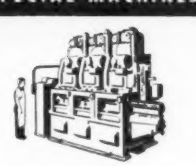
How to get the right machine for your work



Investigate the many services and physical equipment available from Sundstrand "Engineered Production." Call in a Sundstrand engineer, or write for bulletin 674. There is no obligation for this service.

TRIPLEX RIGIDMILS | SPECIAL MACHINES





SUNDSTRAND
Machine Tool Co.
2530 Eleventh St. • Rockford, Ill., U.S.A.

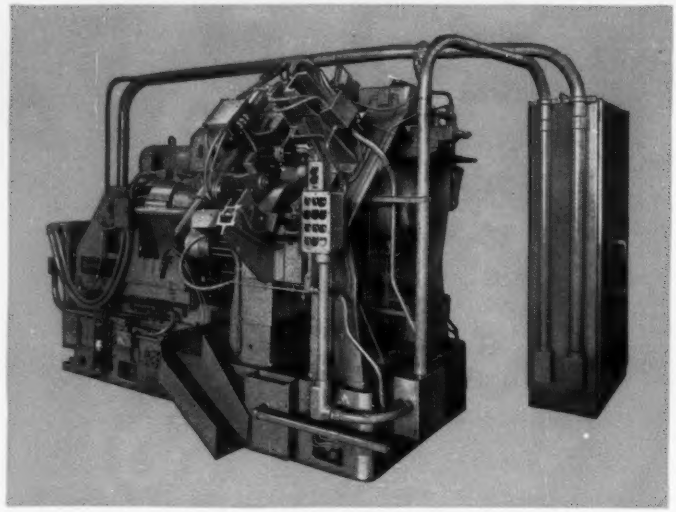
FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**

drilling

chamfering

reaming

tapping



FULLY AUTOMATED PRODUCTION

8000

operations per hour on BarnesdriL special production machine

Maximum output with fully automatic production is obtained from this Special BarnesdriL Production Machine, due to continuous machining with no time necessary for operator actuation.

Gear blanks are fed by conveyor from automatic lathes to the loading station on the machine. Here a loading arm picks up each blank and the machine clamps it in the holding fixture. Blanks are drilled, chamfered, reamed and tapped on each of ten holes per blank, or a total of 8000 operations per hour. After drilling a probing unit automatically gauges holes for size. The machine after completing the cycle discharges blanks into a chute for conveyor removal. In case of inadequate depth of holes or broken tools, a warning signal appears and the machine stops automatically.

If you have parts requiring high speed automatic production, consult BarnesdriL engineers for estimates and production recommendations. Full range of cycle operations are available with cycle time engineered to meet production requirements.

WRITE FOR BULLETIN NO. 150D

DETROIT OFFICE: 3419 South Telegraph Road, Dearborn, Michigan

HOLE BARNESDRIL FINISHING

BARNES DRILL CO.

820 CHESTNUT STREET • ROCKFORD, ILLINOIS

MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

Duplication

Duplication

KOPY-KAT Duplication

is a direct hydraulic transfer with no intermediate motions

machining is completely automatic

there is no chance for irregularities or error in final work

The KOPY-KAT is adaptable to an endless variety of duplicating jobs, from the simplest to the most complex. Manufactured specifically by Rockford Machine Tool Co. for use on new machines, it becomes an integral operating part of any hydraulic shaper, planer or slotter on which it is installed.

Investigate the KOPY-KAT which duplicates automatically with the ease of straight-production machining . . . and faithfully reproduces many forms previously considered impossible to machine.

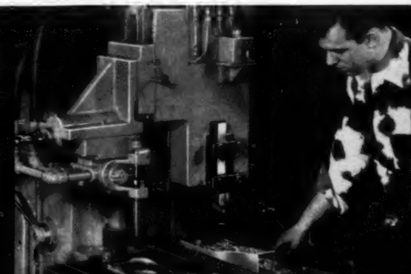
Ask a Rockford Machine Tool Co. representative for further information . . . or write directly to us.

Hy-Draulic

Reg. U.S. Pat. Off.

Kopy-Kat Installed on Hydraulic Slotter

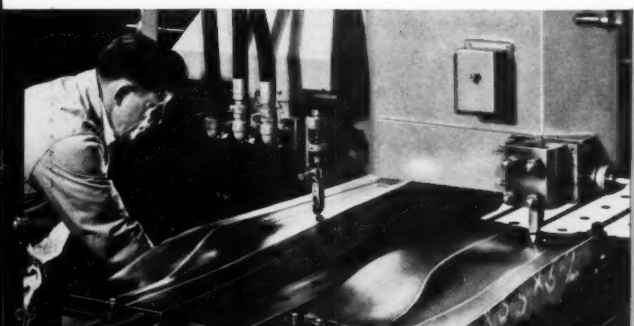
Kopy-Kat Installed on Hydraulic Ram Shaper



SHAPERS · PLANERS · SLOTTERS · SHAPER-PLANERS · LATHES

MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

Kopy-Kat Installed on Hydraulic Planer



A new motion picture film "The Rockford Kopy-Kat" is available through your local distributor.

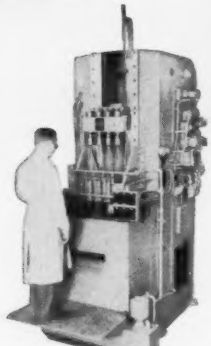
ROCKFORD MACHINE TOOL CO. ROCKFORD, ILLINOIS

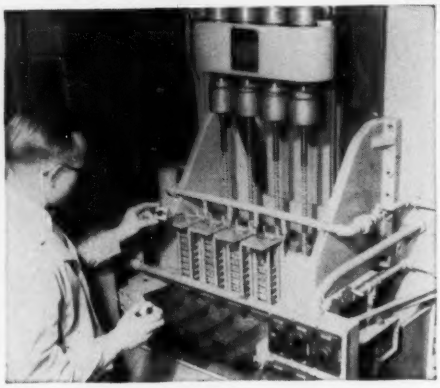
FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**

AUTOMATED BROACHING
BALANCED PRODUCTION

with two machines

ANOTHER *American* FIRST

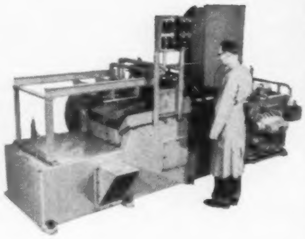


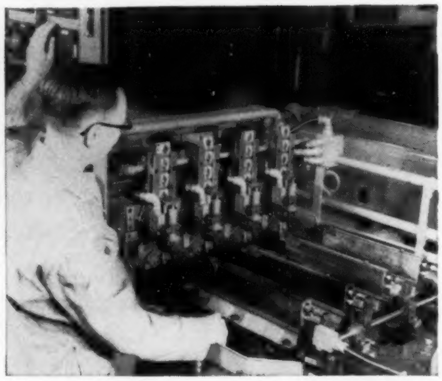


At the vertical machine, the die-cost aluminum parts are fed from hoppers into magazine feeds, the hole is broached and the parts automatically ejected onto a conveyor. Cycle is continuous.

This "working team" of two American Broaching Machines produces 3,000 rocker arm brackets per hour.

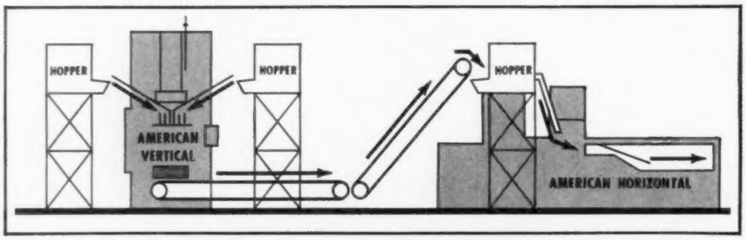
An American (VP) vertical hydraulic internal pull-up broaching machine, arranged for 4-station operation, broaches the ¾" diam. hole in the part. The part is then conveyed to a hydraulic broaching machine, which straddle broaches the sides of the parts. The feeds, broaching strokes and ejectors of the two machines are completely automated to provide continuous, balanced production.





Expanding arbors of the horizontal machine pick up the parts from magazine feeds and push them past stationary broaches which straddle broach the sides. Parts are ejected automatically on the return stroke.

American machines, broaches and fixtures are made in sizes and types to fit your exact requirements. Why not let American engineers solve your broaching problems. Send a part print or sample. Ask for Catalog No. 450.



American BROACH & MACHINE CO.

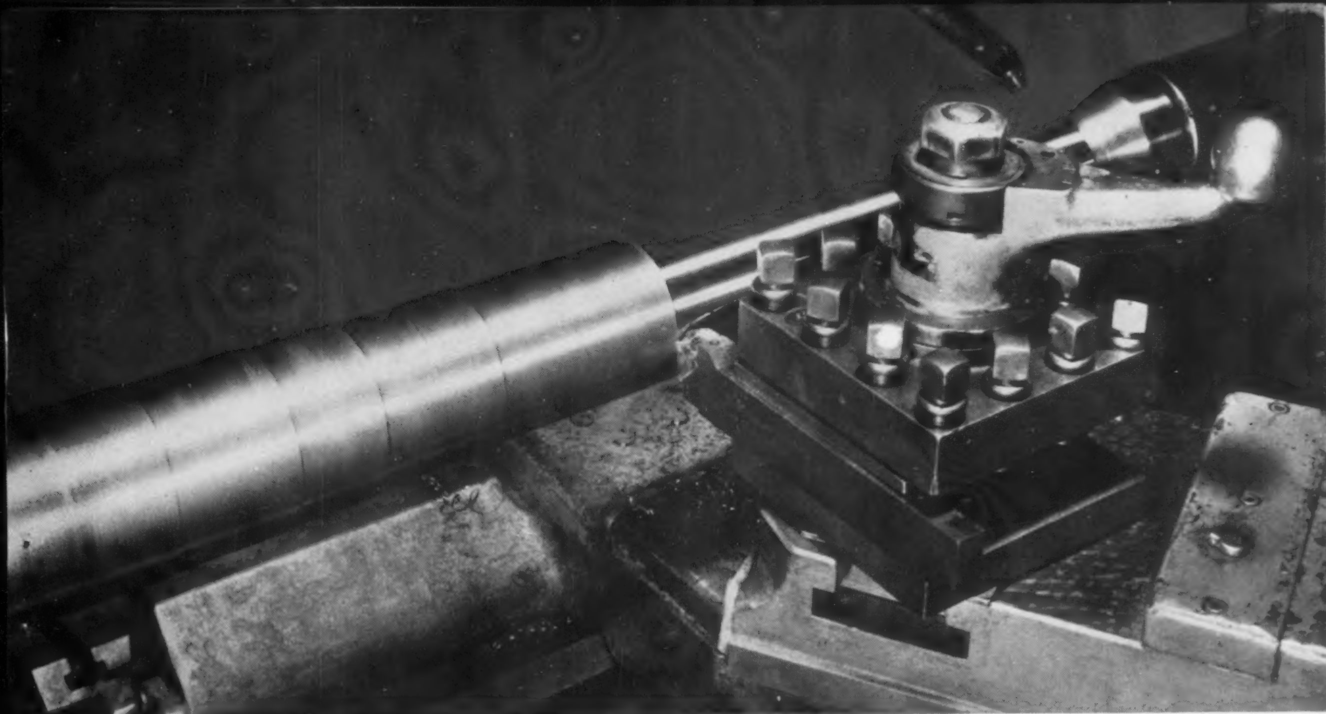
A DIVISION OF SUNDSTRAND MACHINE TOOL CO.

SUNDSTRAND

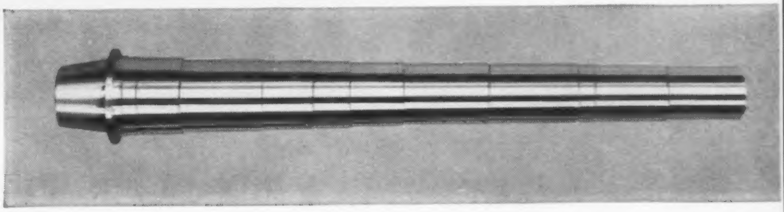
American Building - Ann Arbor, Michigan

See *American* First — for the Best in Broaching Tools, Broaching Machines, Special Machinery

MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**



Carboloy Cemented Oxide finishes 31-inch lathe spindles in 2.8 minutes at R. K. LeBlond Machine Tool Co. Carbide tool used previously required 6 minutes. With the Cemented Oxide tool, the 12-step cut is made at 715 fpm – more than double the speed with carbide. Work finish is improved, and machine output is increased 45% per grind.



Takes up where carbides leave off . . .

FINISH STEEL WITH CARBOLOY CEMENTED OXIDE; GET FINER FINISHES AT HIGHER MACHINE SPEED

With new Carboloy® Cemented Oxide, you can finish steel faster than ever before possible. Specially developed for machining at speeds beyond the range of carbides, Cemented Oxide produces superior surface finishes, while reducing your machining costs.

Cuts faster, wears longer

Field and laboratory tests show Carboloy Cemented Oxide can be used effectively at speeds from 300 to 7500 fpm, on steels up to 300 Brinell. It cuts cleanly, resists edge wear and cratering at surface speeds which would quickly ruin other cutting materials.

Carboloy Cemented Oxide brings you two major advantages: It lets you cut faster – and therefore more efficiently – with your present equipment; it reduces the time required to complete a job. And, its unusual wear-resistance at these high speeds means less downtime for tool changes, lower tool and grinding costs.

Resists chipping, stays cool

Cemented Oxide is an entirely new kind of cutting material. It is harder than carbide, stronger and more resistant to chipping than typical ceramics. Even at extremely high operating speeds, the tip stays so cool it can be touched immediately after the cut.

With Cemented Oxide Grade 0-30 and the three Carboloy extra-performance carbide grades, you now have a specialized cutting material available for every steel-cutting job from roughing to super high-speed finishing. Limited quantities of Cemented Oxide Grade 0-30 are ready for evaluation on your finishing jobs. For information or technical bulletin, send the coupon on page 4 of this advertisement.

CARBOLOY

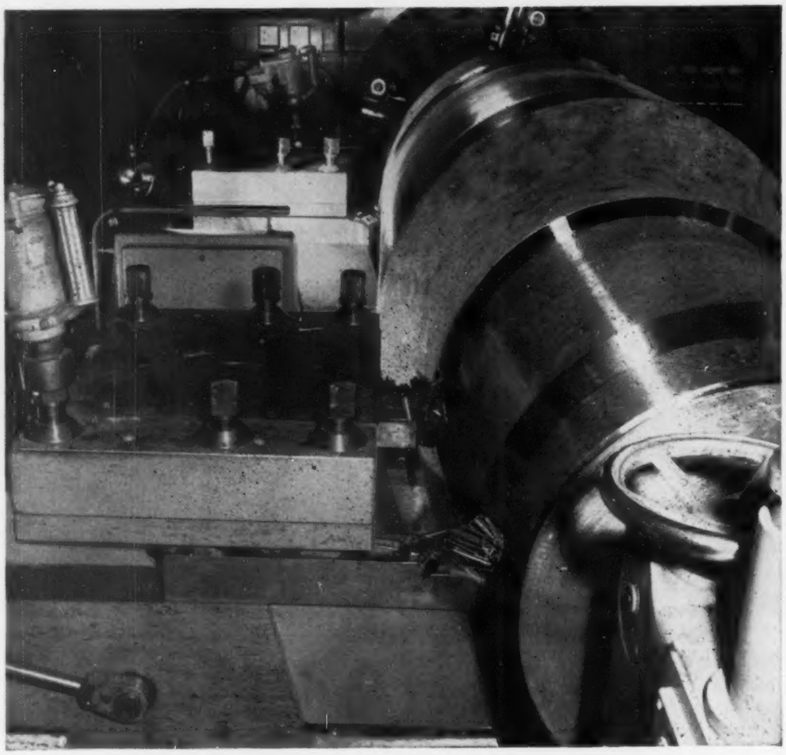
CEMENTED OXIDE

GRADE 370

EXTRA-PERFORMANCE CARBIDE FOR HEAVY-DUTY ROUGHING

Grade 370 is built to take heavier roughing cuts at higher speeds and feeds . . . yet outlast conventional carbides. Hundreds of in-plant tests have proved Grade 370 will remove more metal per minute – and take more regrinds – than any other grade.

For example, on huge steel backup rolls like the 31-ton roll at right, a single Grade 370 insert has removed 24,000 cubic inches in 2½ hours . . . without regrinding. Cutting through rough scale and hard seams, Carboloy Grade 370 tools will finish this job in 16½ hours.



For every job from roughing to finishing . . .

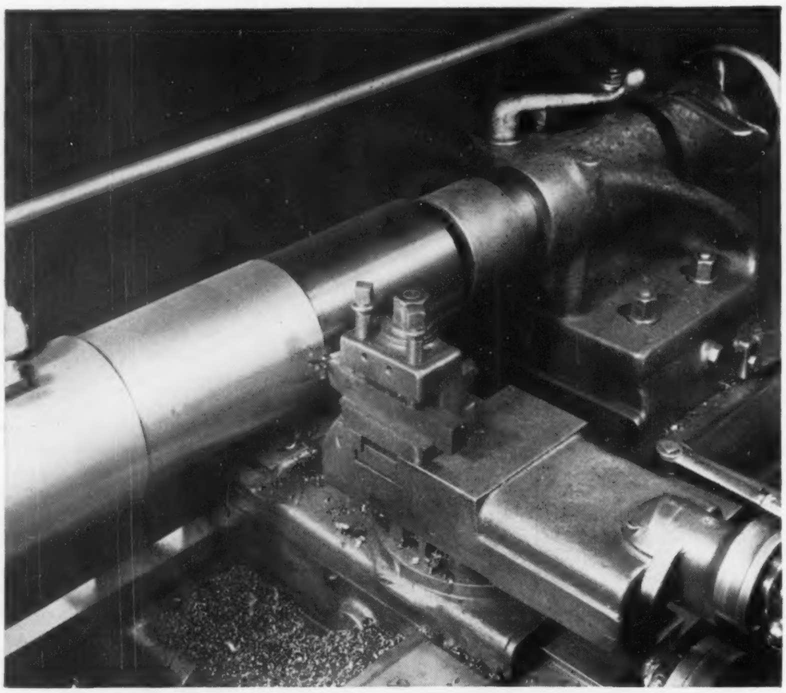
CUT STEEL FASTER, LOWER TOOL COSTS WITH

GRADE 330

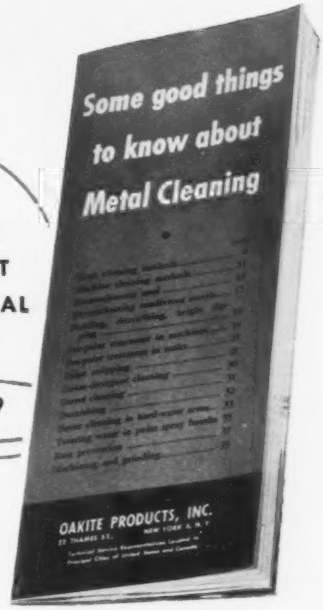
EXTRA-PERFORMANCE CARBIDE FOR FINISHING AND BORING

New Carboloy Grade 330 is twice as strong as conventional steel-finishing grades. Its entirely new composition makes 330 easier to braze, yet more resistant to chipping. Unlike other finishing grades, Grade 330 is so tough it can be ground on automatic grinders without cracking.

Grade 330 can take speeds 10% higher than other carbides, without loss of tool life. When compared at a series of speeds ranging from 600 to 1900 fpm, Grade 330 outlasted other grades by 20%-35%. (Picture at right shows surface finish obtained on S.A.E. 1045 steel at 800 FPM.)



Oakite's FREE Booklet on Metal Cleaning



answers many questions that mean better production, more profit for you. Just look at the table of contents:

Tank cleaning methods

Electrocleaning steel

Electrocleaning nonferrous metals

Pickling, deoxidizing, bright dipping

Applying iron phosphate coatings in preparation for painting

Applying zinc phosphate coatings

Cleaning, removing rust and conditioning for painting in one operation

Machine cleaning methods

Paint stripping

Steam-detergent cleaning

Barrel finishing, burnishing

Better cleaning in hard water areas

Treating wash water in paint spray booths

Rust prevention

Coolants and lubricants for machining and grinding

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Send me, without obligation, a copy of your booklet: "*Some good things to know about Metal Cleaning*"

NAME ____________________

COMPANY ____________________

ADDRESS ____________________

You'll want to know the answers

Can one cleaning material do all metal-cleaning jobs? *See page* 5.

What kind of cleaner attracts both oil and water? How does this help remove buffing compound residues and pigmented drawing compounds? *See page 8.*

Why clean ferrous and nonferrous metals in separate tanks? *See page* 10.

What are the advantages of reverse current for electrocleaning steel? *See page 15.*

For electrocleaning nonferrous metals, what are relative advantages of cathodic, cathodic-anodic and soak-anodic cleaning? *See page* 17.

Can you electroclean brass without tarnishing? *See page 18.*

How do bright dips make metals brighter? *See page* 21.

Can you clean steel and condition it for painting for less than 20 cents per 1,000 square feet? *See page 24.*

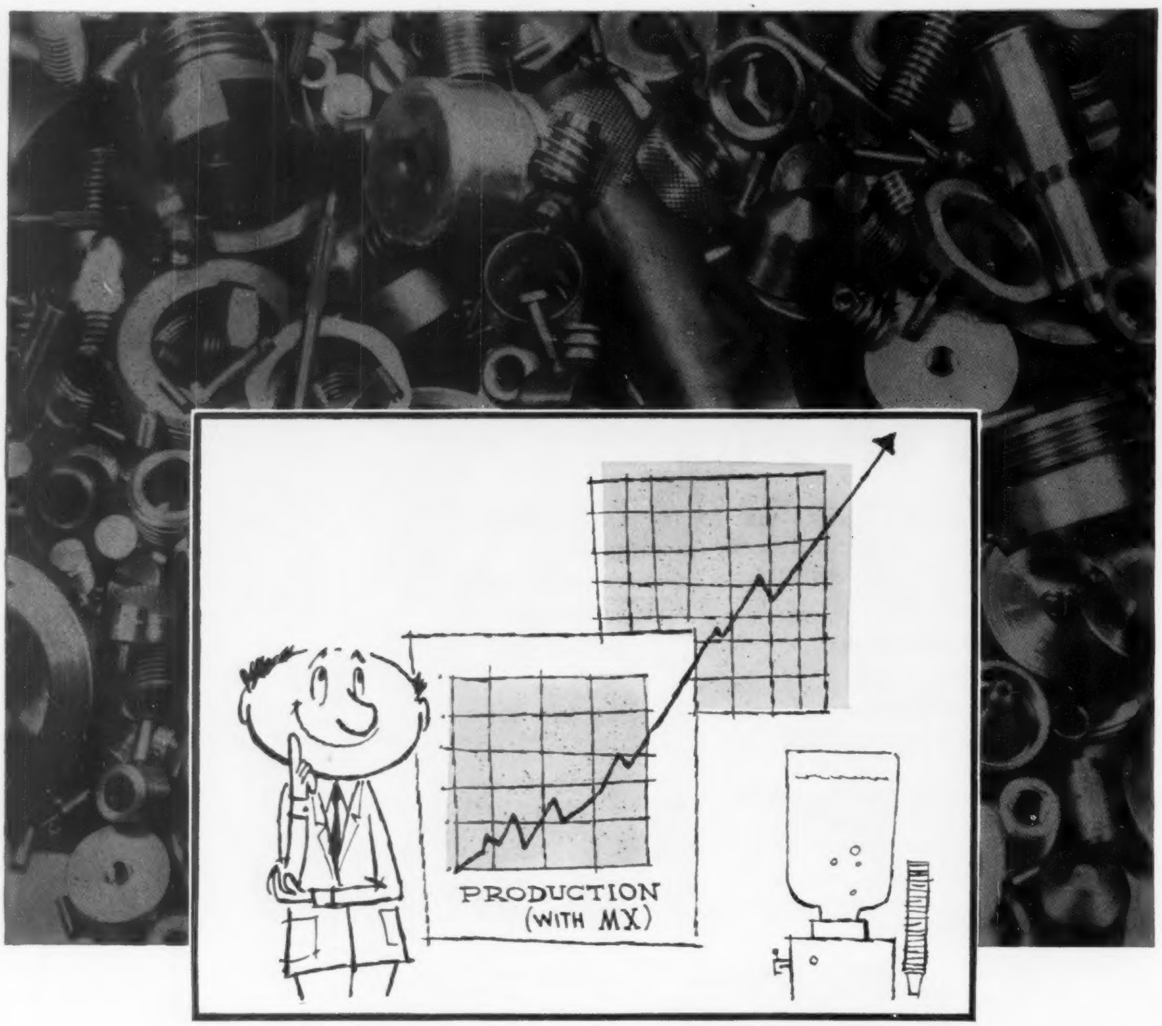
Would you like a cleaner that removes rust and oil at the same time; often eliminating all need for pickling? *See page* 28.

What's the best way to clean parts that are too large to be soaked in tanks or conveyed through washing machines? *See page 30.*

Does your burnishing barrel produce a luster you are proud of? *See page* 32.

What do you do when the overspray neither sinks nor floats in the wash water in your paint spray booth? *See page 35.*

Do you dry steel parts before anti-rusting? *See page* 37.



PLEASANT THINGS HAPPEN when you put USS Free-Machining MX Steel to work. You'll find that you can use cutting speeds as much as 50% greater than the speeds at which regular Bessemer grades are normally run. Your production will increase from 10 to 50%. Tools will last up to twice as long. Part finish will be better. And you'll have fewer rejects.

What's more, USS MX has so consistently outperformed ordinary screw stock that we can promise you with complete confidence that *MX will cut the cost of any part* you now machine from regular Bessemer grades. It's been proved in hundreds of shops.

And here's another reason why MX is your best buy today. USS Free-Machining MX has been successfully machined at speeds up to 350 SFM—speeds far higher than the average (under 250 SFM) used in most shops today . . . yet it costs no more than ordinary screw stock.

Switch to MX. Produced, in all the popular screw stock sizes, this production-boosting, cost-reducing steel is sold in cold-finished form by your regular supplier, either as "MX" or under his own identifying trademark. In hot-rolled form, MX is available direct through our nearest district sales office.

UNITED STATES STEEL CORPORATION, PITTSBURGH
AMERICAN STEEL & WIRE DIVISION, CLEVELAND
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA.
UNITED STATES STEEL SUPPLY DIVISION
WAREHOUSE DISTRIBUTORS, COAST-TO-COAST
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

Bigger output . . . longer tool life . . . lower costs

—when you do the job with free-machining MX

USS

UNITED STATES STEEL

For more information fill in page number on Inquiry Card, on page 225

AVOID the HIGH COST and difficulty of fabricating long, hard & straight parts by conventional methods . . .

THOMSON

60 Case hardened and ground

SHAFTS, ROLLS, GUIDE RODS and other long-round parts

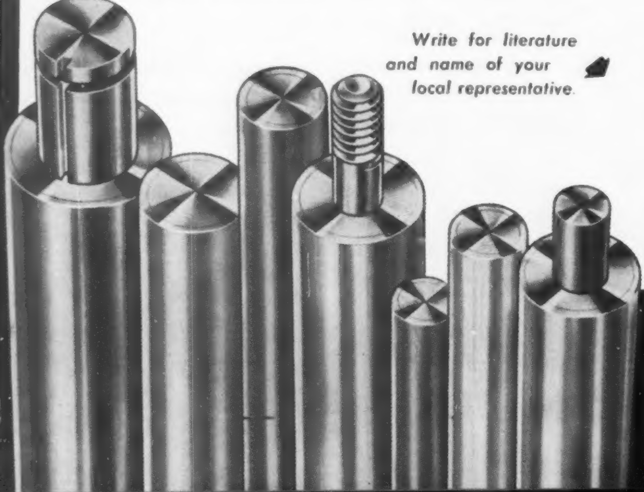
60 Case is the result of over ten years of experimental work and production experience with hardened and ground shafts which are a requirement for BALL BUSHINGS, the Linear Ball Bearing manufactured by Thomson Industries, Inc.

The special techniques and equipment that have been developed enable high production rates and low handling costs. This permits big savings over conventional methods which are plagued with erratic warpage, straightening and resultant grinding problems. Finished *60 Case* parts frequently cost less than the scrap losses that result from conventional methods.

60 Case material has a surface hardness close to 60 on the Rockwell C scale which is essential to resist wear.

Long lengths of material ranging in diameter from ¼" to 4" are stocked to enable prompt shipment of *60 Case* parts, with or without special machining.

Write for literature and name of your local representative.



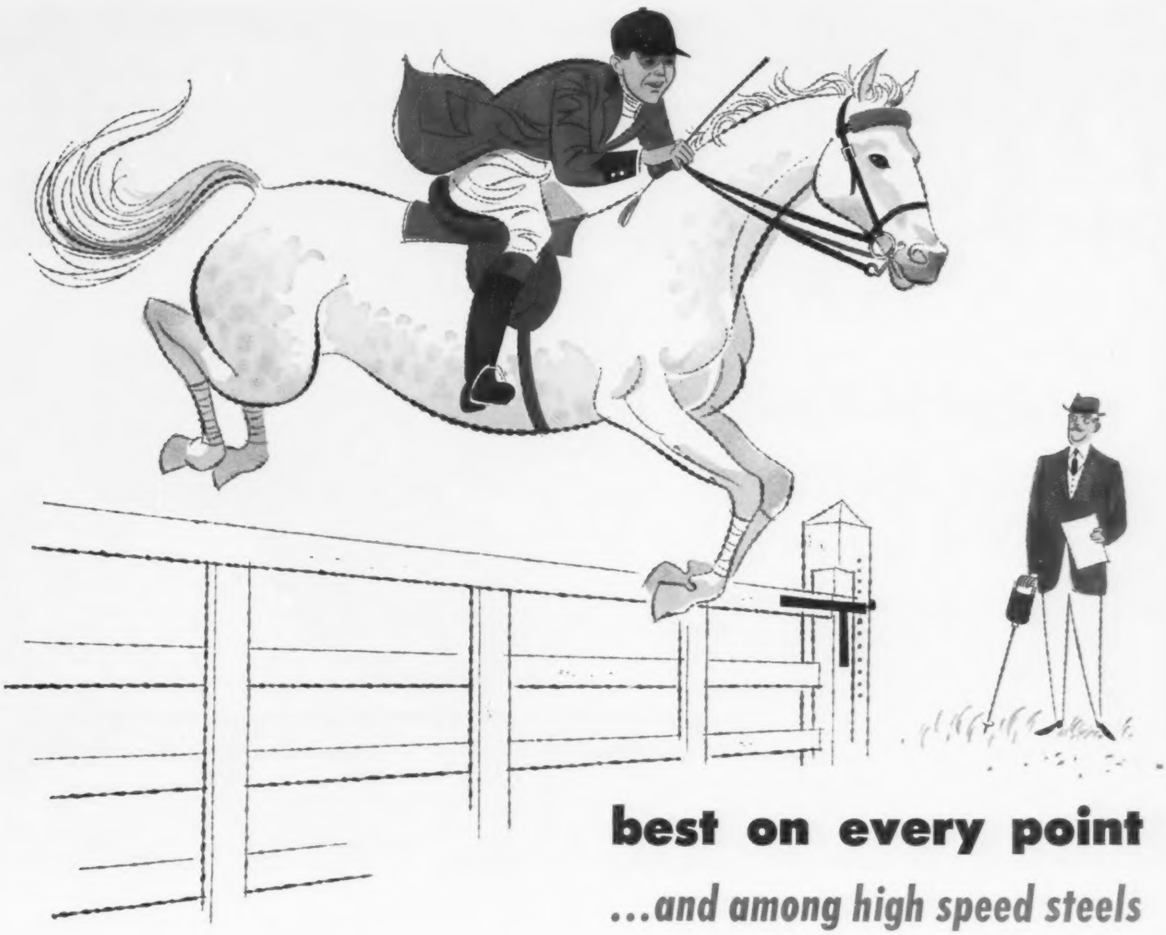
ADVANTAGES of *60 Case*

- COST REDUCTION
- HARD BEARING SURFACE
- ACCURATE DIAMETERS
- GROUND FINISH
- STRAIGHT PARTS
- DELIVERY FROM STOCK
- ADDED STRENGTH
- UNIFORM HIGH QUALITY

TYPICAL *60 Case* PARTS

GUIDE RODS, SHAFTING, ROLLS, TRAVERSE RAILS, PISTON RODS, ARBORS, LEADER PINS, TIE RODS, KING PINS, AXLES, CONTROL RODS, GUIDE POSTS, MANDRELS, BEARING ROLLERS, SPINDLES

THOMSON INDUSTRIES, Inc.
Dept. C6, Manhasset, New York



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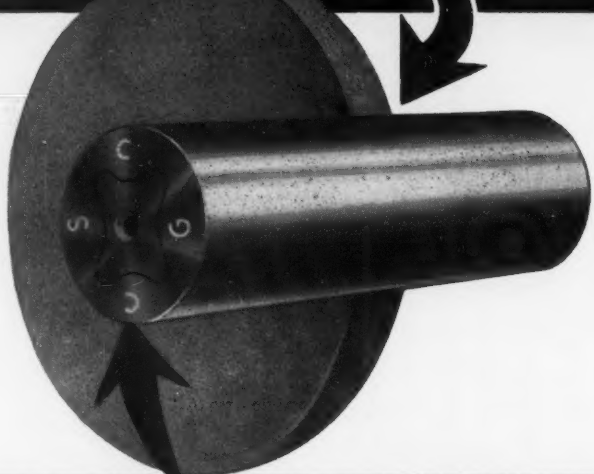
An exclusive GRINDING PROCESS...

makes

CUMBERLAND

STEEL BARS

concentric, straight,
smooth & *really* accurate



BE SURE OF THIS MARK ON THE END OF YOUR SHAFTS

CUMBERLAND GROUND BARS FOR ALL TYPES OF MACHINES

They are carefully ground to our standard manufacturing tolerance, plus nothing to minus .002″ on diameters 1-1/8″ to 2-7/16″ inclusive . . . plus nothing to minus .003″ on diameters 2-1/2″ to 8″ inclusive. Closer tolerance can be furnished, if desired. And, remember, Cumberland Steel Bars are the end result of 109 years' experience,—and every bar is *carefully tested* before shipment. The list of Cumberland's customers reads like the "Blue Book" of Industry. Ask for further information.

MANUFACTURED IN THREE SPECIFICATIONS

Cumberland Brand—AISI C-1020/C-1025, Elastic Limit 30,000# Min.
Potomac Brand—AISI C-1040, Elastic Limit 45,000# Min.
Cumsco Brand—AISI C-1141, Elastic Limit 57,000# Min.

CUMBERLAND STEEL COMPANY

CUMBERLAND, MARYLAND, U.S.A.

ESTABLISHED 1845 — INCORPORATED 1892

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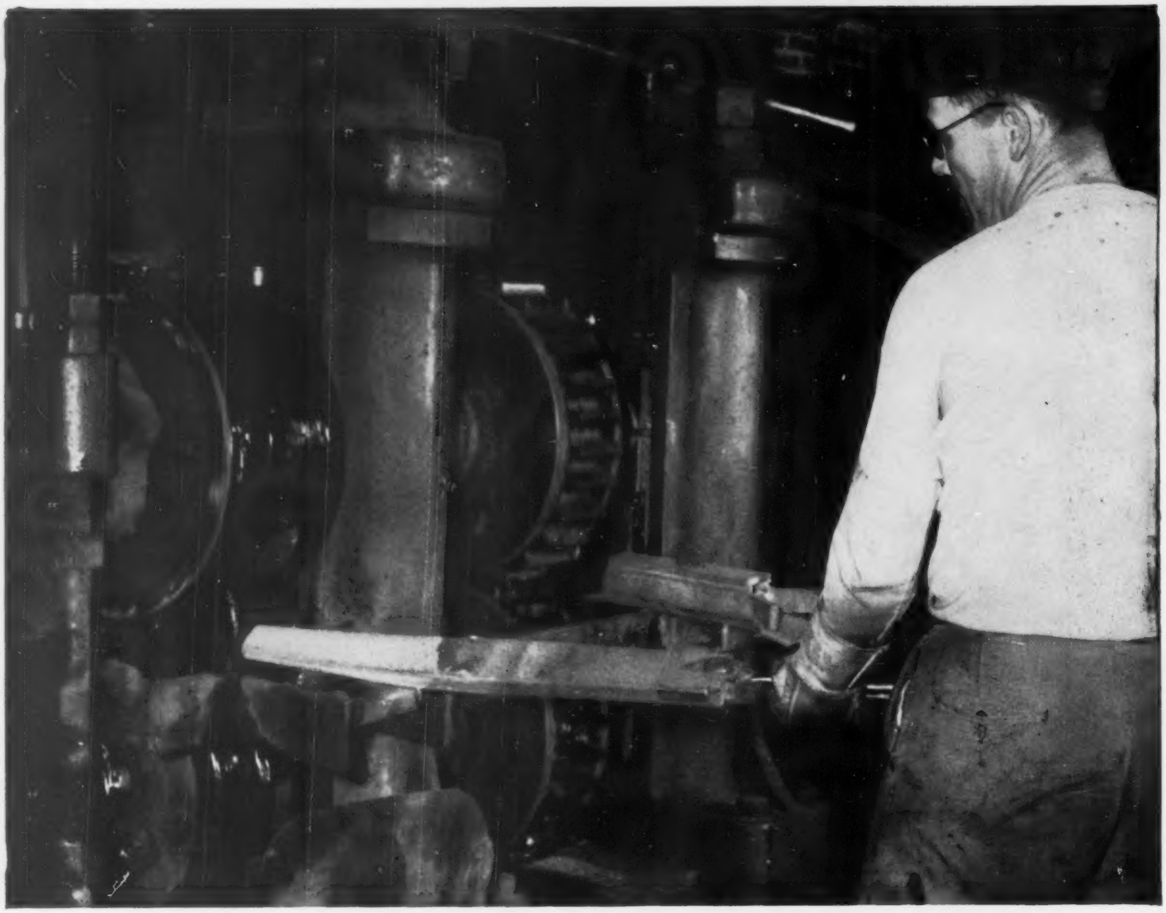

10 TIMES THE PRODUCTION LIFE

FROM THESE "CAST-TO-SHAPE" SWAGING DIES

The John Deere Plow Works of Deere & Company formerly used cast grey-iron dies to swage AISI 1070 F steel plow beams. Die life was, at best, a mere six weeks or about 8,000 parts.

They switched to A-L CAST-TO-SHAPE swaging dies of FCC No. 66 tool steel, hardened and drawn to 57-58 Rockwell "C". The new dies ran *fourteen months*—eight hours a day, five days a week—before redressing was necessary. Approximately *83,875 Parts* (over ten times the production) were swaged in that period! Production has been maintained at that level since.

You, too, can save time and money with the modern FCC CAST-TO-SHAPE method of tool and die making. Don't forget, you also buy *less* steel and reduce machining costs. It's a matter worth investigating. ● Check with your A-L representative TODAY . . . or write *Allegheny Ludlum Steel Corporation, Oliver Building Pittsburgh 22, Pennsylvania.*

SEND FOR THIS NEW CATALOG "FORGING AND CASTING PRODUCTS"

It's hot off the press with full details on FCC Air Hardening, Oil Hardening and other Cast-to-Shape Tool Steel Specialties that can save you time and money . . . also Composite Die Sections, and Smooth-Hammered Forgings in a wide range of tool and stainless steels. *Don't wait—get your copy NOW.*

Write Today

ADDRESS DEPT. M-84.

For complete **MODERN** Tooling, call

Allegheny Ludlum

AL FINE TOOL STEELS SINCE 1854

W&D 4681

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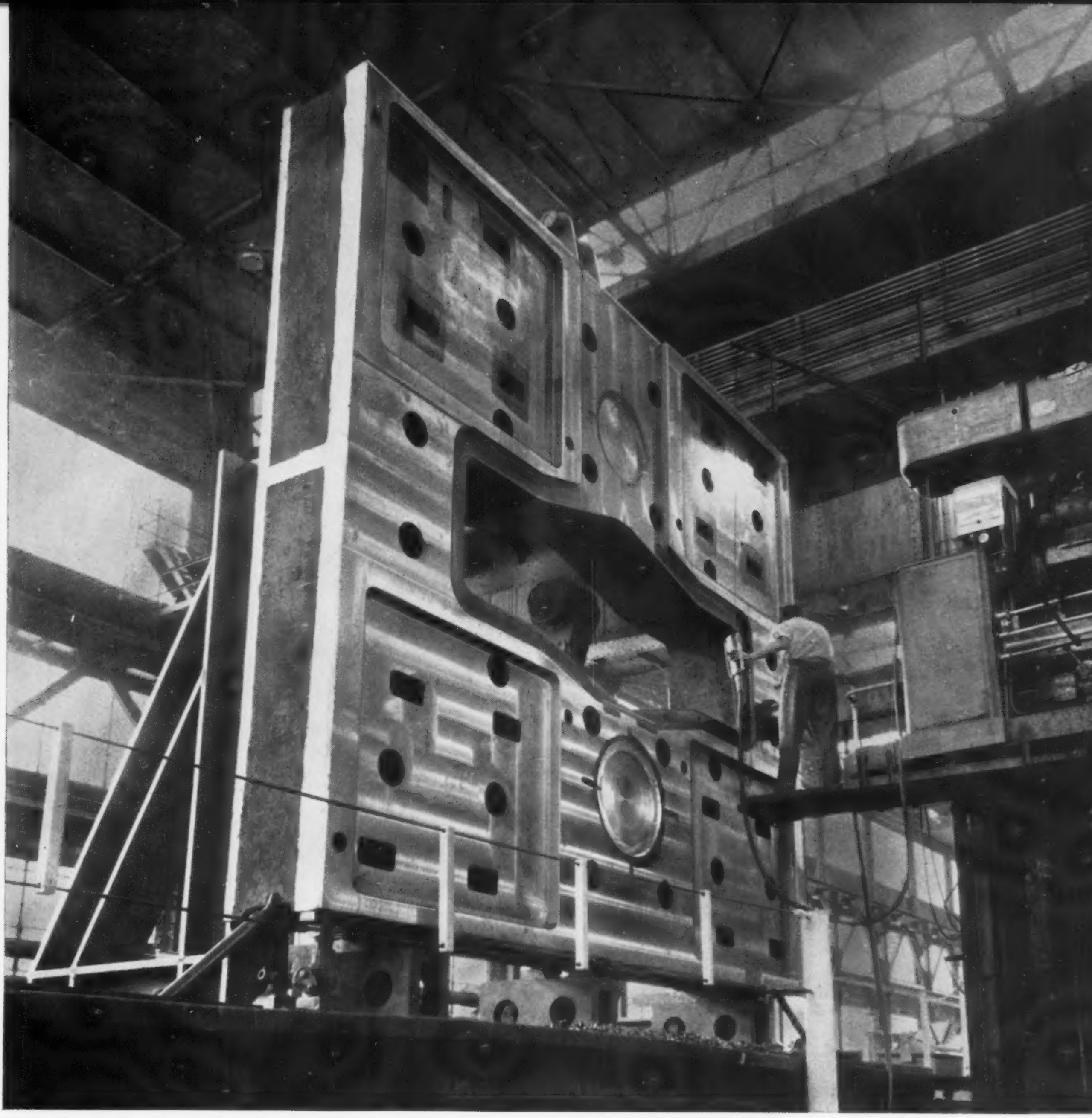

95-ton casting for counterblow forging hammer

This steel casting is of interest for several reasons, not the least of which is its size. By any standards it is a big one—approximately 223 in. long, 202 in. wide, 28 in. deep. As you see it here it has been planed on both sides, and the pockets on the side facing the camera have been milled out.

The huge casting will be used as the base plate of a counterblow forging hammer. The intricate piece was cast in one of the Bethlehem foundries, then moved to a neighboring Bethlehem shop for machining. The plans called for a finished weight of 189,000 lb—almost 95 tons.

Heavy castings like this have been a Bethlehem specialty for years. In design they have ranged from the very simple to the highly complex and difficult. You will almost always see many unusual types of castings in Bethlehem's foundries and machine shops, which are equipped to handle an unlimited variety of work.

If your own jobs require steel, iron, or bronze castings, large or small, we suggest that you be sure to investigate the services Bethlehem offers. They leave nothing to chance. When you are next in the market, we will welcome your inquiries.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

Half Mile of Hot Weld Flash Trimmed Per Grind

HAYNES STELLITE alloy cutting tools trim red hot weld flash from 3200 automobile wheel blanks without chipping, spalling, or losing their sharp cutting edges. The temperature of the weld is at 1500 deg. F as the tools slice through the flash. During the operation, the tools are subjected to thermal shock as they come in contact with the hot metal . . . and to severe impact as they cut through chilled sections and irregular weld surfaces. Yet they remain in operation for a full 8-hour shift.

Three HAYNES STELLITE alloy tools are used on this job. One rough machines the weld and the following two take finishing cuts. They remove 10½ in. of flash from each wheel blank, and trim a half mile of flash per grind.

HAYNES STELLITE tools remove metal fast. They can be used at high speeds with comparatively high feed rates, and they take deep cuts. They have good impact strength, high compressive strength, and retain their hardness at red heat temperatures. This combination of properties makes them extremely valuable on any machining job.

For information on how HAYNES STELLITE tools can help you speed up your machining operations, write for the booklet "HAYNES STELLITE Metal-Cutting Tools." It gives helpful information on chip formation, tool design, grinding procedures, and the machinability of metals.

"Haynes" and "Haynes Stellite" are registered trade-marks of Union Carbide and Carbon Corporation.

HAYNES
TRADE-MARK
ALLOYS

HAYNES STELLITE COMPANY

A Division of Union Carbide and Carbon Corporation

UCC

General Offices and Works: Kokomo, Indiana

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Tool Steel Topics

BETHLEHEM STEEL

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

This die, made from Lustre-Die by Eagle Tool and Machine Co., Hillside, N. J., produces plastic part shown below.

Lustre-Die Tool Steel Fills Bill for Makers of Plastic Parts

So you're looking for high lustre! Just wait until you see the job you get when you use Lustre-Die, Bethlehem's new plastic-molding tool steel.

Lustre-Die is ideal tool steel for making plastic parts because it has properties which enable it to take such a high polish.

Sturdy and good looking, this plastic section for detergent can top was made from die of Lustre-Die.

One glance at Lustre-Die and you'll think you're looking in a mirror.

Lustre-Die is a special, electric-furnace steel of well-balanced analysis. It is alloy-fortified to increase its depth of hardenability and mechanical properties. It is also heat-treated by means of oil-quenching and tempering to a hardness of Brinell 302-352.

BASIC ANALYSIS

Carbon 0.50 Manganese 1.00 Silicon 0.30
Chromium 1.10 Molybdenum 0.25
(plus Alloy-Fortification)

Lustre-Die is such a clean, clean steel. It is carefully inspected to ensure freedom from porosity or surface pitting. Machining is easy, too, as the steel is free from nickel. Besides, there are no additives to cause inclusions, which could cause spotty areas on the die surface.

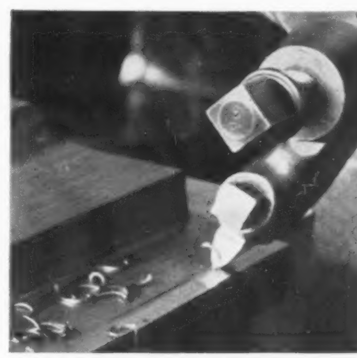
If you would like to purchase a trial piece of Lustre-Die, simply get in touch with your Bethlehem tool steel distributor.

BETHLEHEM TOOL STEEL ENGINEER SAYS:

Unusual Metal "Pickup" on Tools Is Caused By Carburization

Metal "pickup" occurring on the surface of tools used in shearing, blanking or forming metal can be an annoying problem. When such "pickup" is routine and expected, it is customary to provide continuous maintenance to remove the adhering metal. But when it suddenly occurs in an operation normally free from "pickup," the trouble can be serious.

Recent investigations have shown that the most common cause of unusual "pickup" on tools is the unsuspected presence of an unwanted carburized case, unintentionally placed on the tools during heat-treatment, and therefore not removed by grinding after heat-treatment. On many grades of tool steel, a high carbon case causes retained austenite to form during heat-treatment. As the austenite is very soft, its presence on the surface of otherwise hard tools is sufficient reason to account for metal "pickup." A regrinding operation on the tool usually removes the austenitic skin, eliminating the trouble.



GOOD RESULTS WITH 66 HS

Bethlehem 66 HS (High-Speed) tool bits can always be counted on for smooth, steady cutting. In the operation illustrated, the 66 HS bit is shaping a bending die. 66 HS, because of its well-rounded 6-5-4-2 analysis, has all the properties needed for economical high-speed work.

For more information fill in page number on Inquiry Card, on page 225

Joe Doesit, Machine Operator, says:

"I LIKE MY GEOMETRIC DIE HEADS because...

...they never let me down. You see, I'm on piece work and if one of these Die Heads acted up, it would mean the same as a cut in pay. But you can always count on a GEOMETRIC Head to stand the gaff. They're plenty rugged. I like the quick way you can change chasers, too."

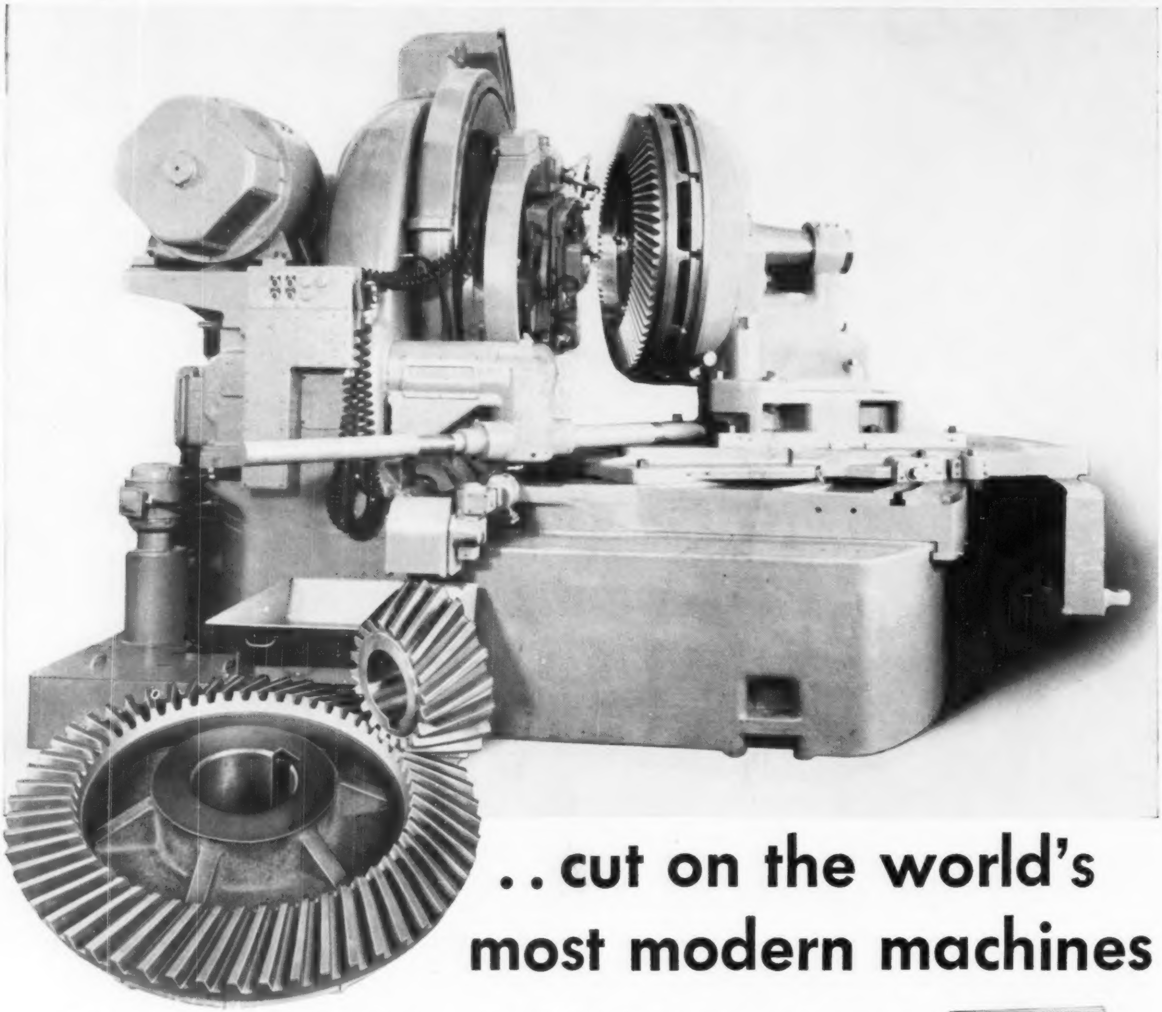
Greenfield Tap and Die Corporation

GEOMETRIC TOOL COMPANY DIVISION

New Haven 15, Connecticut

GEO MET RIC

NOW spiral-bevels up to 72" diameter, 10" face width



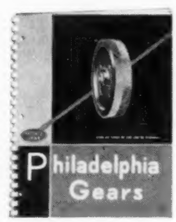
..cut on the world's most modern machines

Our addition of a new 72" Generator assures the widest possible selection of Spiral-Bevel Gear diameters and face widths available anywhere—diameters up to 72"; face widths to 10". Even in these massive sizes, accuracy of tooth shape, and precision of gear and pinion operation are assured.

Acquisition of this modern, new machine is another step in keeping Phillie Gear one of the world's best equipped, largest and most progressive gear manufacturing plants.

Regardless of the type, size or quantity of gears needed, you are assured of Quality, Service, Delivery and Courtesy, when you call upon Phillie Gear—world leader in gear manufacturing—with nearly 65 years experience.

Send for our new 76-page Gear Book, on your Business Letterhead.



phillie gear®

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INDUSTRIAL GEARS & SPEED REDUCERS • LIMITORQUE VALVE CONTROLS • FLUID MIXERS • FLEXIBLE COUPLINGS

Virginia Gear & Machine Corp. • Lynchburg, Va.

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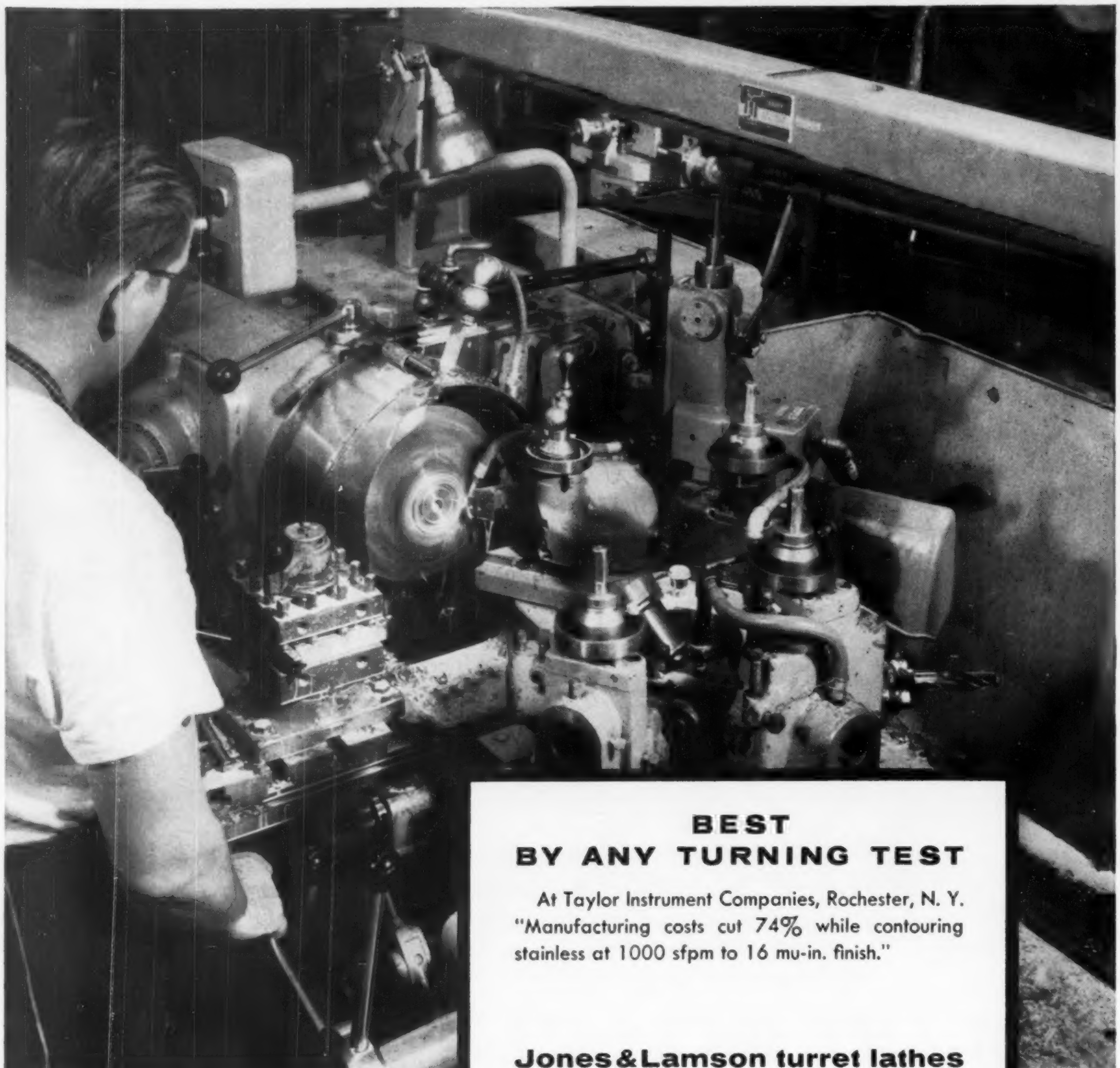

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carbide NEWS

The Wesson Study Tells You:

1. To what extent your own industry is already using single point tools with throw-away tips.
2. What the future plans of your industry are with regard to use of throw-away tooling and why.
3. To what extent your industry is considering the use of throw-away blades for milling, boring, etc.
4. To what extent plants of your size can use throw-away tooling effectively.

WESSON can also help you select the right kind of throw-away holders and tips to give you maximum performance and economy, cut machine down time, reduce inventory and improve product quality.

Ask us to prove it.

WESSON makes national survey data available

Industry Reports Big Jump in Use of Throw-Aways

HOTTEST NEWS in the carbide tool field right now is the astounding growth in popularity of "throw-away" tooling as revealed by the survey of metalworking industries by Wesson Company.

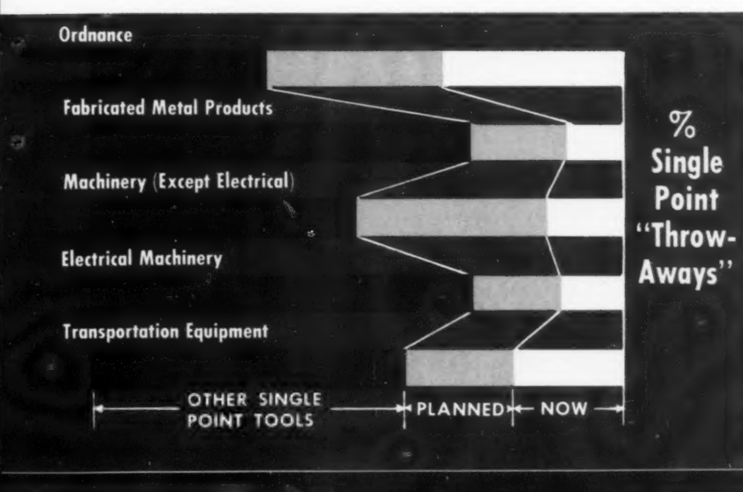
Conducted through an independent technical market research organization, the study shows:

1. Industry is seriously considering assigning a majority of all single point tool operations to "throw-aways". Some plants are thinking in terms of "as near 100% as possible".

(continued on next page)

THE BIG THREE IN THE THROW-AWAY FIELD - - -

***#1 INDUSTRY SAYS IT WANTS** the features which WESSON has incorporated in all of its holders for single point tooling with indexable disposable tips, including STANDARD REPLACEABLE PARTS, ADJUSTABLE CLAMP WITH CARBIDE FACED CHIP BREAKER, ONE PIECE ANVIL LOCATOR, etc., etc. If you are not familiar with these holders, be sure to ask us for complete data covering holders for your types of operations. Our Bulletin 55-11-M will help you to do this quickly.*



carbide NEWS

Industry Reports Big Jump in Use of Throw-Aways

(continued from page 1)

2. "Throw-aways" already represent over 15% of all single point tooling in metalworking plants. In those plants already using "throw-aways," the percentage is 25% of all single point operations.
3. Industry is receptive to the idea of using milling cutters that require no grinding on an even broader basis.
4. Industry is also seriously considering the use of no-grind (throw-away tipped) tooling for other multiple point tooling such as boring tools, etc. on a broad basis.
5. Primary reasons for industry's interest in tooling up with tips that are thrown away when dull are:
   a. Elimination of all tool grinding.
   b. Important reduction in machine down time for tool changes.

   Other factors include lower tool cost, reduced inventories, etc.

Included in the Wesson study are analyses of trends in the use of single and multiple point tools with throw-away tips by industry and by plant size (based on annual tool consumption). Results of the survey are available on request to all USERS of carbide tools.

THE BIG THREE IN THE THROW-AWAY FIELD - - -

#2 ***THE WESSON "NO-GRIND" Milling cutter, introduced at the Tool Show in Chicago promises to launch a new era in milling in the metal-working industries, according to reports by the industry itself. Using disposable carbide tips with eight cutting edges each, it eliminates all cutter grinding, reduces milling cutter inventory, cuts overall costs per piece.***

#3 ***THIS MICRO-ADJUSTABLE BORING TOOL with no-grind disposable inserts is one of a series developed by Wesson. It has all the features, apparently, that industry is looking for.***

"No-Grind" Chamfering Tools Added to Wesson Standards

Two new holder styles designed for 30-degree and 45-degree chamfering operations have been added to Wesson's line of standard Multicut holders for throw-away carbide inserts.

The holders offer wide versatility, being applicable also to straight turning, plunge feed turning and facing operations. The 30-degree lead angle style designated TDRC-TDLC is also suitable for 90-degree shoulder turning by angling the holder in the tool block. The 45-degree lead angle holder style is designated SERC-SELC.

Both holders incorporate low cost, standard replaceable parts including a one-piece insert seat and locator, adjustable carbide faced chip breaker-clamp, and locking screw. The TDRC-TDLC employs standard triangular "No-grind" inserts while the SERC-SELC are designed for use of standard square inserts which provide a total of eight cutting edges before discarding.

The large clearances provided in the design of these holders make them especially suited for "gang" setups. Sizes available are shown on Bulletins 896-1A (SERC-SELC) and 896-2A (TDRC-TDLC).

- 9" column; 3' or 4' arm
- spindle speed ratio of 40-to-1
- 12 speeds (up to 3200 rpm) through direct-reading dial
- automatic tapping reverse
- adjustable spring counterbalance (feel remains the same from lightest to heaviest tools)
- hardened tang slot
- safety elevating nut and screw (arm can't drop or overrun)
- hardened arm ways for head
- rigid accurate spindle mounted on 5 precision ball bearings

You can acquire this radial for only $.28 an hour, if you operate two 40-hour shifts, by using Gilbert's new financing plan: 6% simple interest (3% add on), up to 5 years to pay (subject to change)

those who buy
GILBERT
buy Gilbert again

newest *high-speed* radial

Your many demands for a high-speed light-duty radial are met—completely and economically—by this new Gilbert 3 hp machine. Compare the features at the right with other radials of equal capacity, and you see why the Gilbert is the best buy in its class. Traditional Gilbert accuracy, fast response, and wide-angle work visibility make your shop more productive, more versatile. Variety of bases, runway mounting, or tables available. Get all the details in Bulletin 255.

The Cincinnati Gilbert Machine Tool Co.
Beekman Street, Cincinnati 23, Ohio

IT'S EASY TO ORDER THE

From this "Buffalo" Line

1 **CAPACITY RANGE** from the smallest commercial drill sizes to 1½" in mild steel.

2 **CHOICE OF FEEDS** — sensitive or power feed, hand or foot controls.

3 **CHOICE OF SPINDLE SPEEDS** — optional motor speeds and adjustable V-belt drive for the right drilling, tapping or reaming speed; or variable speed drive in the famous "RPMster".

4 **CHOICE OF ONE TO SIX SPINDLE MODELS** for single or multiple operations in all capacities.

5 **ACCESSORIES** — such as slow-speed, tapping and mortising attachments, work lights, vise tables and coolant systems.

6 **ARRANGEMENTS** — horizontal duplex, radial, inverted head and many others to make more jobs easier.

BUILT-IN ACCURACY, CONVENIENCE, LONG LIFE

For 79 years, "Buffalo" has been building exclusively industrial drills with the best and most practical features, which we call the "Q" Factor*:

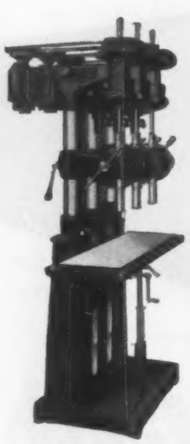
1 **PRECISION BALL BEARING SPINDLES**— high grade steel, ground, polished and dial gauge tested for trueness; take-up adjustment of ball bearings for wear.

2 **CONVENIENT CONTROLS**, table and head adjustment cranks for quickest and easiest handling — excellent visibility of all parts and work.

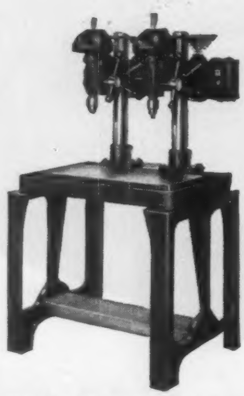
3 **STRONG, RIGID CONSTRUCTION**, including oversize columns, spindles, bases and true work tables. In pedestal models, ways are hand scraped.

Write us about your drilling problem — we'll mail you Bulletins and recommendations.

**The "Q" Factor — the built-in Quality which provides trouble-free satisfaction and long life.*



7/8" No. 16 Drill



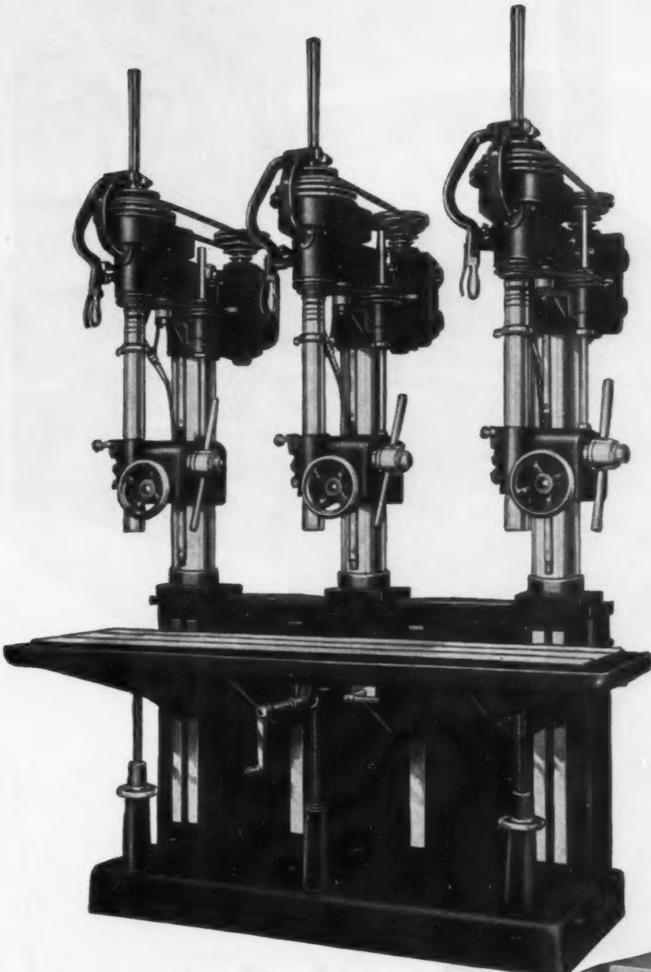
½" No. 15 2-spindle drill

"Buffalo" No. 18 Drill in 6-spindle Bench Model—1" capacity

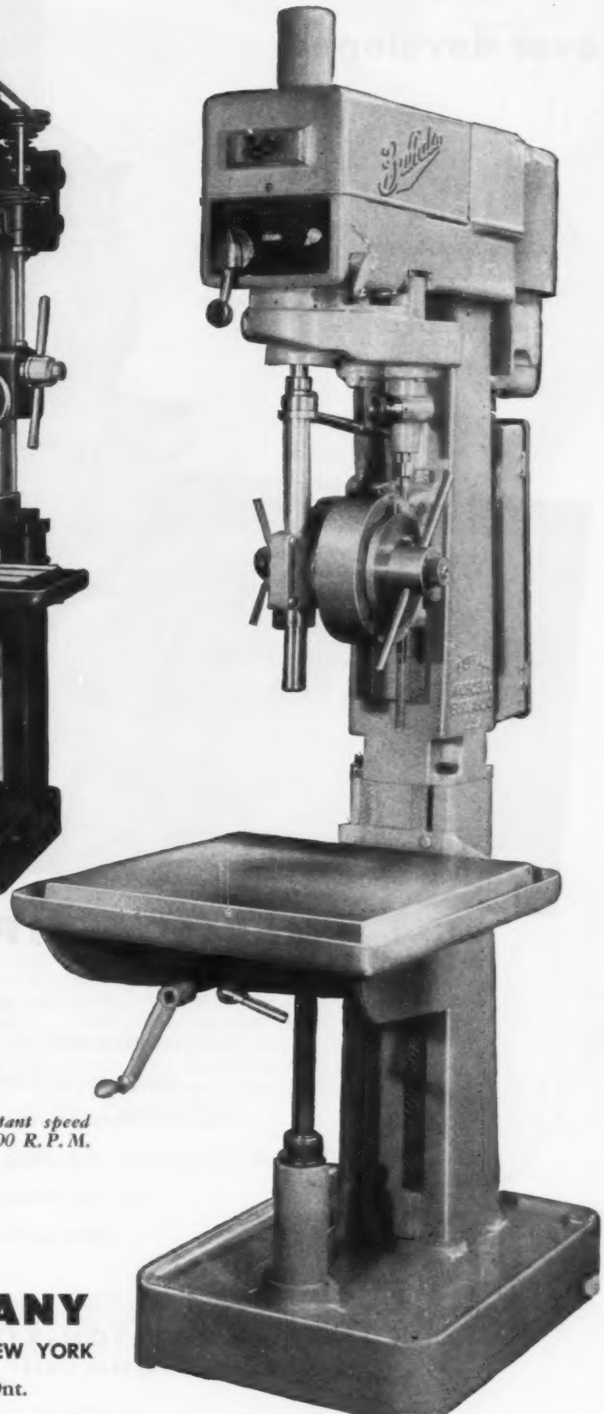
ESTABLISHED 1877 "Buffalo" MEMBER N.M.T.B.A.

DRILLING PUNCHING SHEARING BENDING

BEST DRILL FOR THE JOB



"Buffalo" 3-spindle No. 22 Round Column Drill— power feed. 1½" capacity in mild steel.



The "RPMster" — instant speed control from 100 to 3000 R.P.M.

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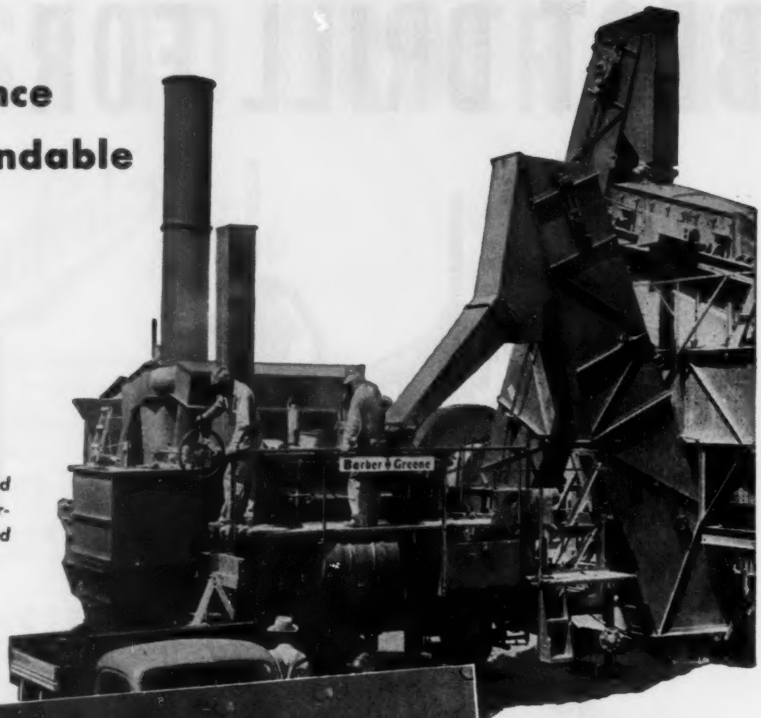
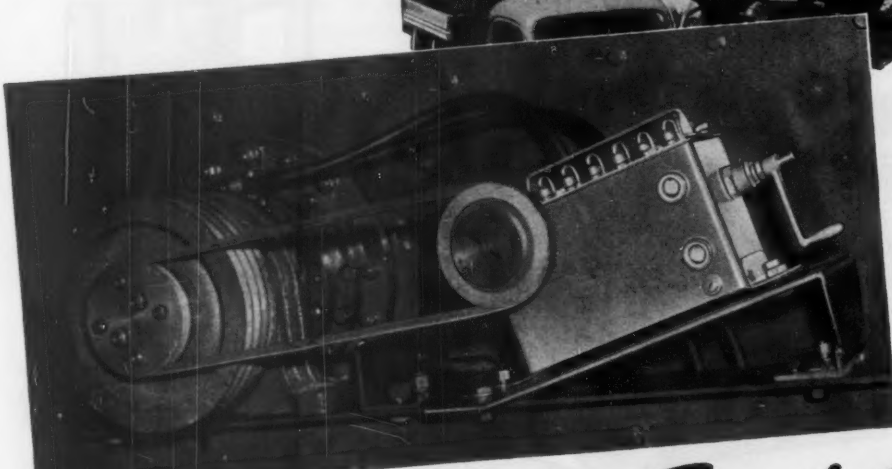
machines of
great performance
use the most dependable
oiling system
ever developed



A Model 50 Madison-Kipp Lubricator installed as original equipment on a Model 848 Barber-Greene Asphalt Mixing Plant manufactured by Barber-Greene Co., Aurora, Illinois.



MADISON-KIPP *Fresh Oil*

. . . by the measured drop, from a Madison-Kipp Lubricator is the most dependable method of lubrication ever developed. It is applied as original equipment on America's finest machine tools, work engines and compressors. You will definitely increase your production potential for years to come by specifying Madison-Kipp on all new machines you buy where oil under pressure fed drop by drop can be installed. There are 6 models to meet almost every installation requirement.

kipp

MADISON-KIPP CORPORATION
203 WAUBESA STREET • MADISON 10, WIS., U.S.A.

• Skilled in Die Casting Mechanics • Experienced in Lubrication Engineering • Originators of Really High Speed Air Tools

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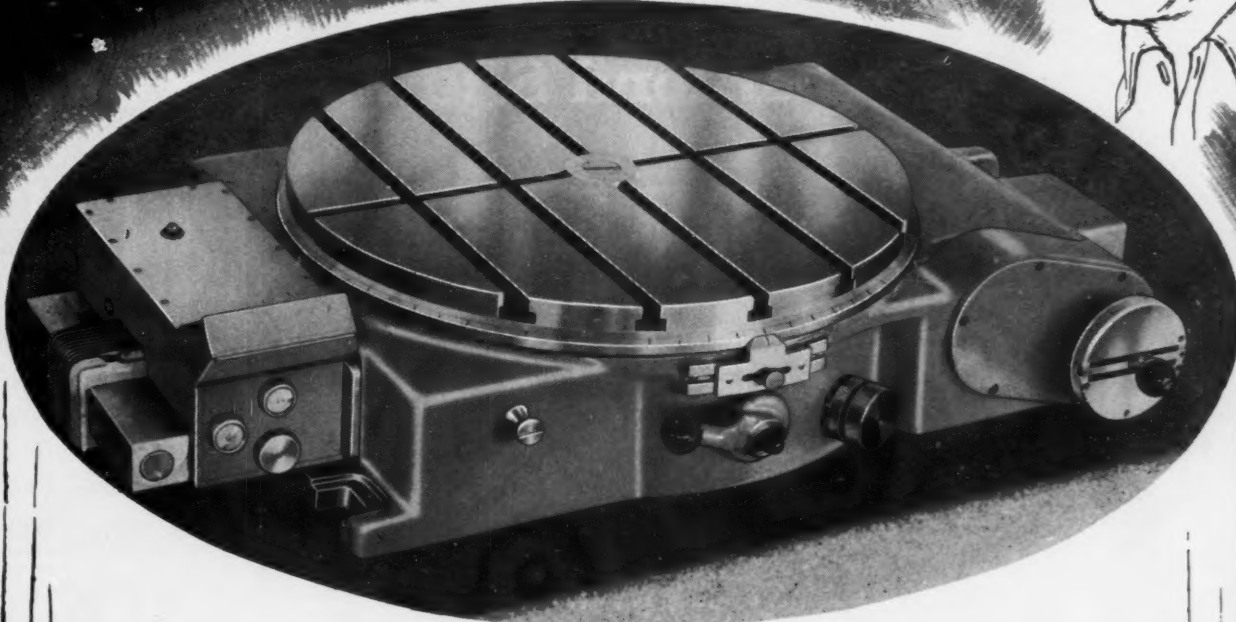
NO SECOND GUESSING
when you set THIS table . . .



because the new PRATT & WHITNEY 24" *Precision* PLAIN OPTICAL ROTARY TABLE gives direct settings to 1 SECOND OF ARC!

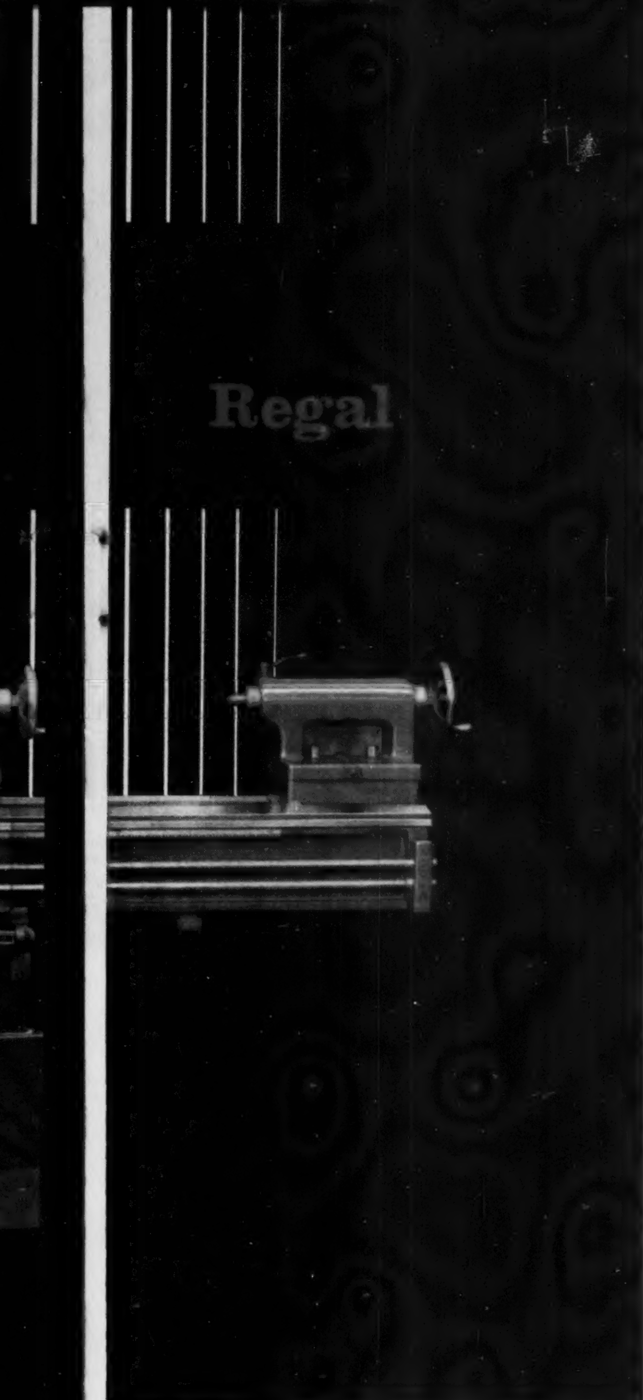
Equipped with an easy-to-read, projection optical system, this 24" Pratt & Whitney Precision Rotary Table provides the MOST CONSISTENTLY ACCURATE MEANS EVER DEVISED FOR PRECISE CIRCULAR SPACING AND ANGULAR POSITIONING. In addition, full 360° adjustment of the optical zero point makes it possible to establish the starting point *anywhere* without disturbing the workpiece. Reversible power rotation insures unequalled speed and ease of operation. Used with Jig Borers or other similar precision machine tools . . . or by itself for inspection or calibrating . . . this one-of-its-kind development will bring new standards of speed, accuracy, efficiency and economy to a wide variety of close tolerance manufacturing operations. For complete information and specifications, write for Circular No. 593. Pratt & Whitney Company, Incorporated, 12 Charter Oak Boulevard, West Hartford 1, Connecticut.

ONE IN A COMPLETE LINE OF P & W PRECISION ROTARY TABLES

PRATT & WHITNEY

FIRST CHOICE FOR ACCURACY

MACHINE TOOLS • GAGES • CUTTING TOOLS


Regal

the finest heavy duty lathes

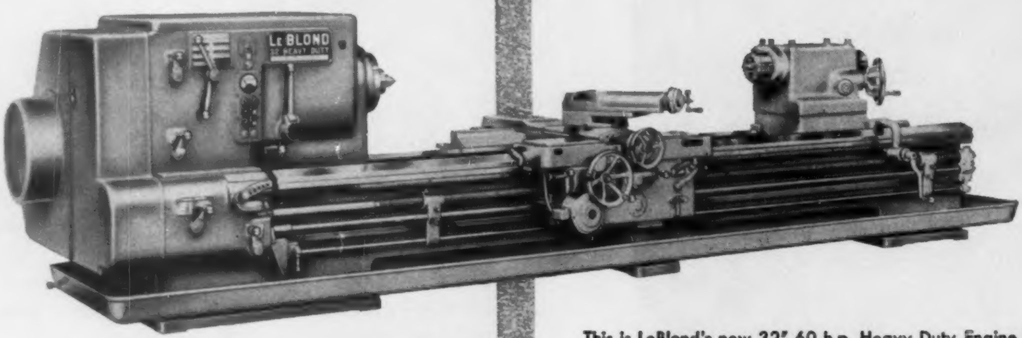
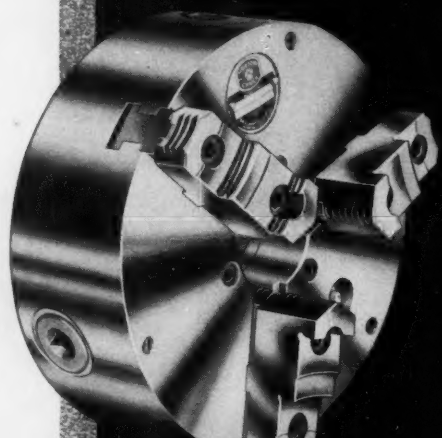


Photo courtesy LeBlond of Cincinnati

This is LeBlond's new 32" 60 h.p. Heavy Duty Engine Lathe. 36 speeds from 4.5 to 500 r.p.m. Adjustable acceleration to bring heavy workpiece up to speed safely. For complete details, write the R. K. LeBlond Machine Tool Co., Cincinnati 8, Ohio. Ask for Bulletin HD-165.

deserve the finest precision chucks



This is Horton's 3-Jaw Scroll Universal Chuck which for more than 100 years has been the companion to the world's finest lathes. Its lasting accuracy and precision contribute to the high production of any tool room or plant. For the complete story on this and Horton's complete line of high production chucks, see the Horton people in your area now.

HORTON
Since 1851
CHUCK

HORTON CHUCK DIVISION
GREENFIELD TAP AND DIE CORPORATION
WINDSOR LOCKS, CONN.

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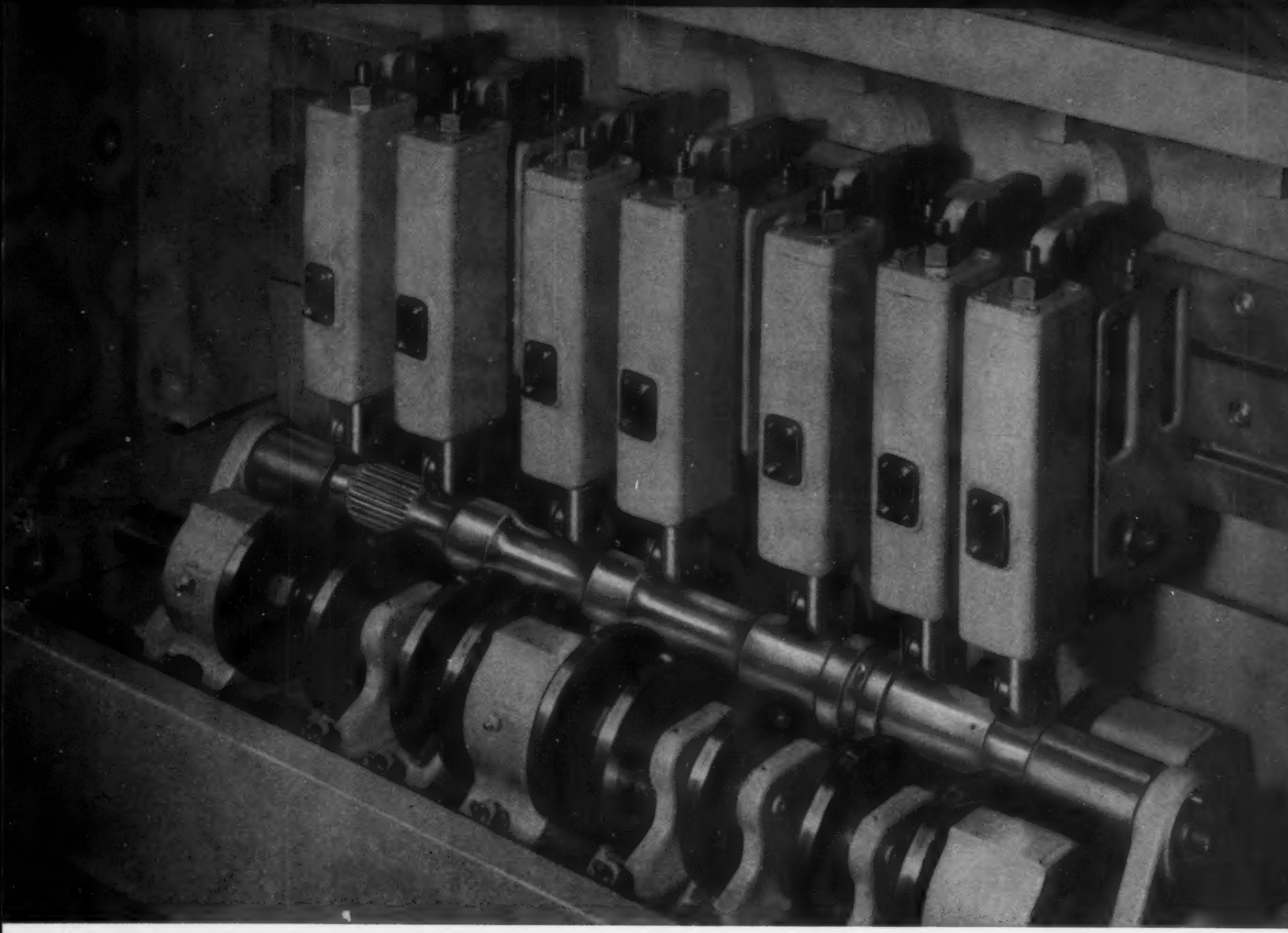


How to eliminate *your* shaft distortion problems

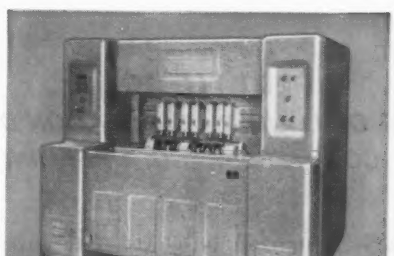
Distortion during hardening is a major production problem.

The Gleason No. 140 Rolling Quench Machine corrects this difficulty, because the quenching and straightening operations are performed at the same time. Because cold straightening is eliminated, valuable production time and expense are saved, and the quenched parts have less residual stress.

Shafts cannot distort because they are rolled under pressure throughout the quenching operation. The operator puts the hot part on the lower rollers and starts the machine. From there on, the quenching operation is automatic. Rolling speed, pressure, and oil flow are pre-set to suit the work that is being quenched.

The automatic quenching cycle saves operator time, and gives *uniform* results for all parts quenched. The pre-set metallurgically correct oil flow gives uniform hardness.

The Gleason No. 140 Rolling Quench Machine is equally suited for small or large quantities. It accommodates shafts $\frac{9}{16}$" to 4" in diameter, 6" to 40" in length, with integral cams or shoulders up to 8" diameter. Tooling can be arranged to hold parts on diameters or centers. Unusual shapes can be handled with additional tooling. Write for further information.



The Gleason No. 140 Rolling Quench Machine also handles multiple quenching of short shafts.

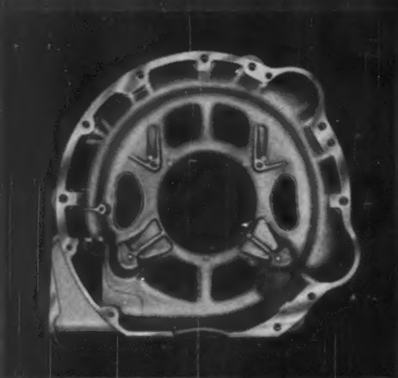
GLEASON WORKS

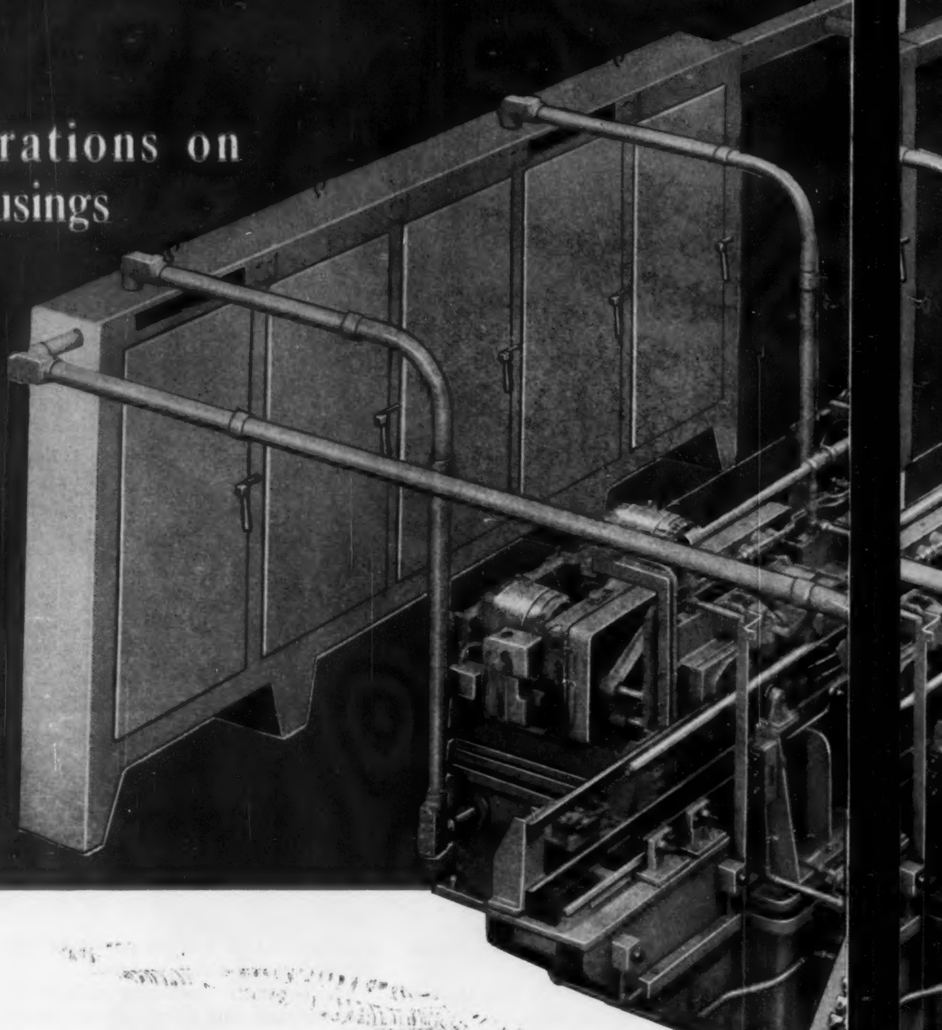
Builders of bevel gear machinery for over 90 years

1000 UNIVERSITY AVE., ROCHESTER 3, N.Y.

Buhr ECONOMATIC

performs 62 operations on torque converter housings





PRODUCTION . . .
200 PIECES PER HOUR AT 100% EFFICIENCY

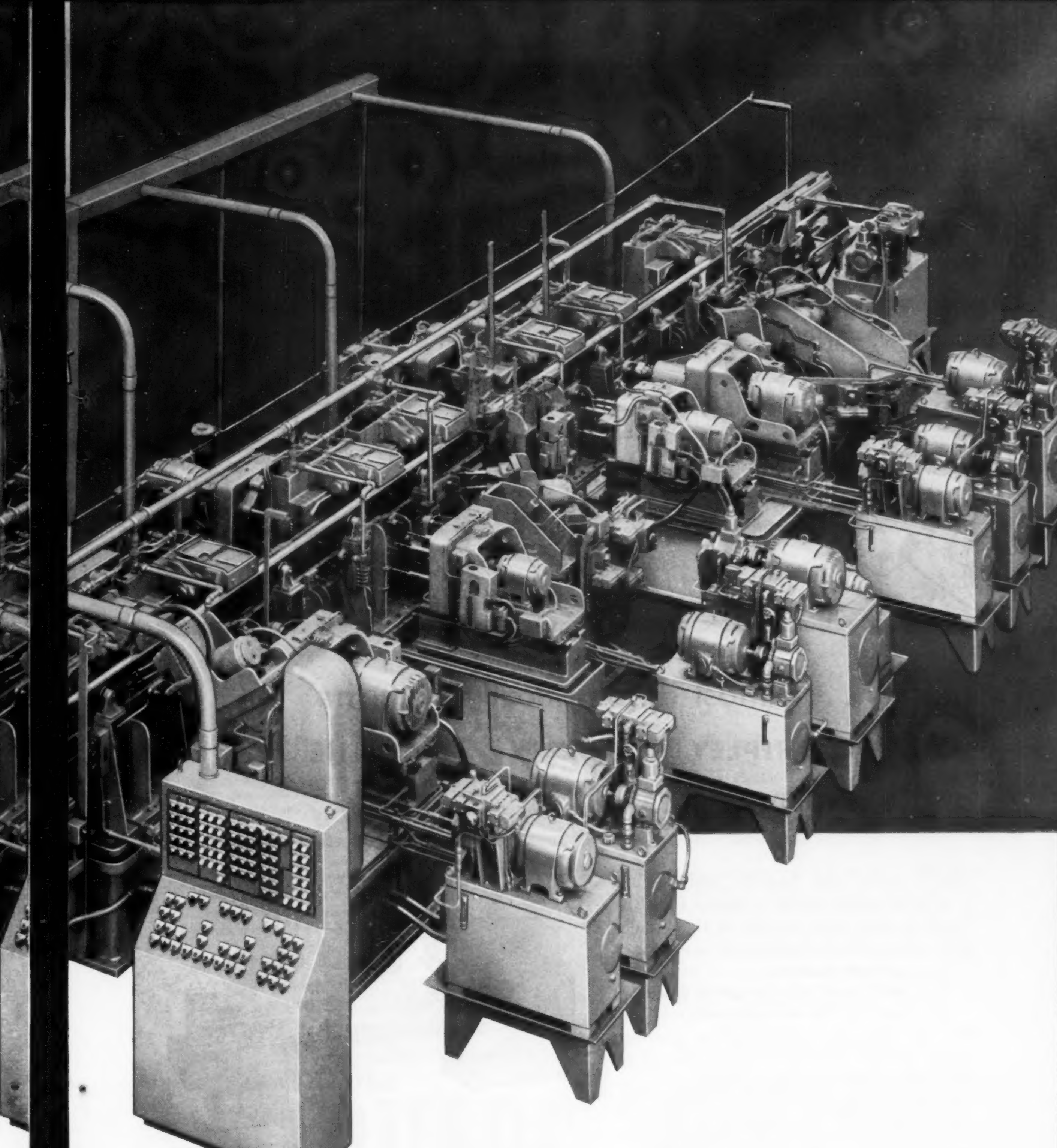
OPERATIONS . . .
36 DRILLING, 2 COMBINATION DRILLING AND REAMING, 7 COUNTERSINKING, 2 REAMING, 1 BORING, 7 INSPECTION AND 7 TAPPING

- Sectionalized bases to facilitate future part changes
- Automatic lubrication of all moving parts
- Mist-lubrication to all spindles to maintain uniform temperature in heads
- All spindles arranged for pre-setting of cutting tools to minimize downtime for tool changes
- All standard and special parts interchangeable for ease of maintenance
- Machine conforms to J.I.C. Standards
- Hardened-and-ground automatically-lubricated steel ways.

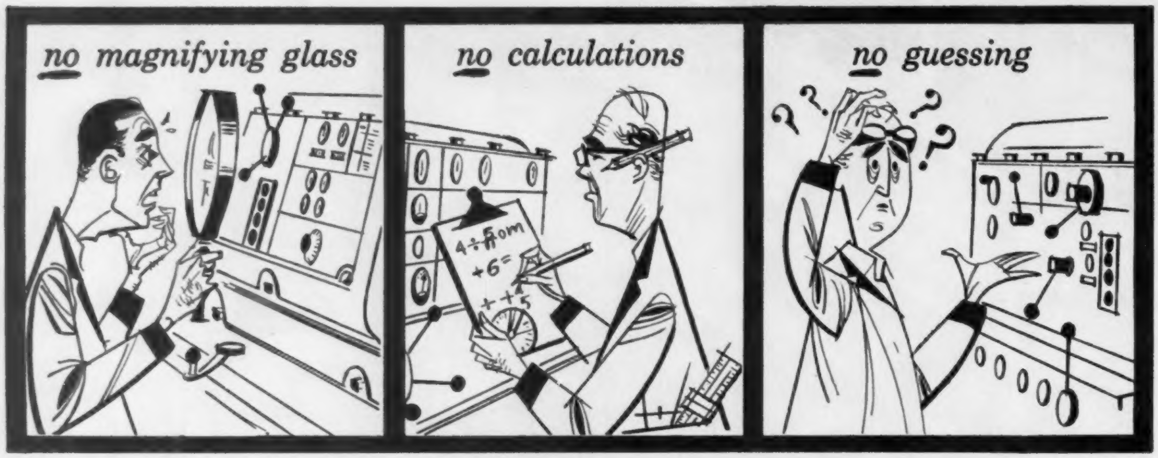
BUHR MACHINE TOOL COMPANY©

ANN ARBOR, MICHIGAN

Solidly Engineered • Precision Built • for World's Leading Manufacturers



Know your feed... set your speed!



quickly . . . almost automatically with the LODGE & SHIPLEY *Powerturn* LATHE and SPEED-DIAL HEAD!

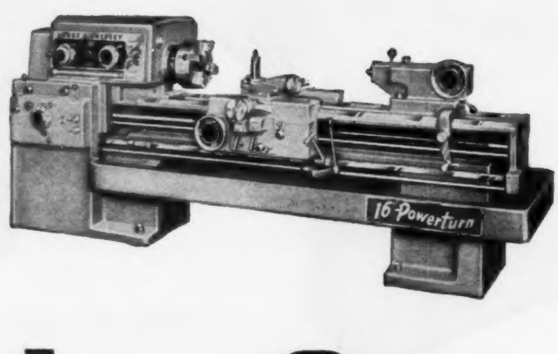
Take "by-guess" and "by-golly" confusion out of lathe operation! Lodge & Shipley POWERTURN Lathes with *Speed-Dial* Head make speed selection and setting simple as **a...b...c!**

a . . . set work diameter

b . . . read r.p.m. opposite cutting speed

c . . . set levers to automatic indicator lights

This time-saving, fool-proof simplicity is but one feature of New POWERTURN Lathes. Combined with traditional Lodge & Shipley accuracy and rugged strength are many other features for new precision and new operating convenience. New literature . . . ready now . . . tells the complete story: how POWERTURN Lathes are designed to facilitate turning to higher levels of profitable operation. 13, 16 and 20-inch sizes; Engine, Toolmaker and Gap types plus famous COPYMATIC with both 45° and 90° tool slides. **The Lodge & Shipley Company, 3055 Colerain Ave., Cincinnati 25, Ohio.**



Lodge & Shipley

your LODGE-ical choice!

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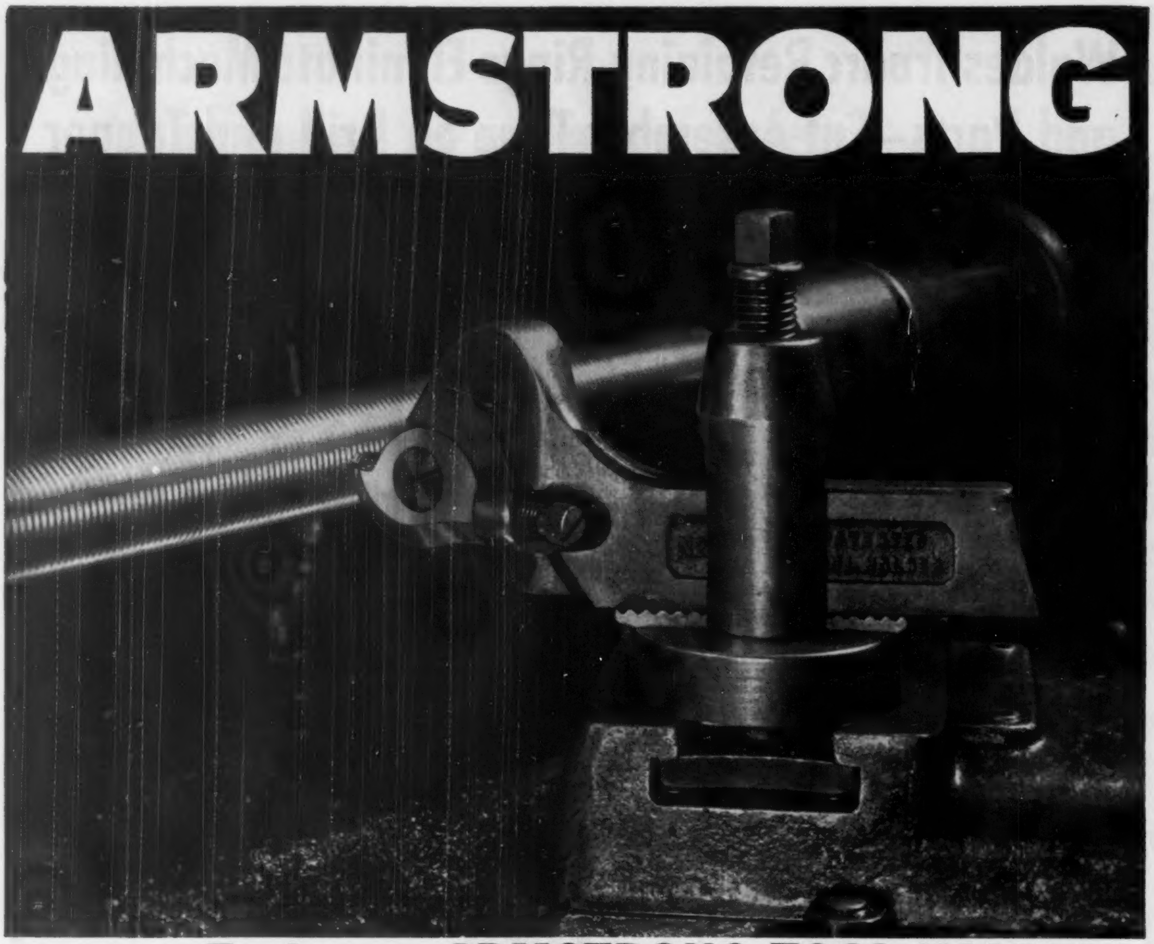


Each year ARMSTRONG TOOL HOLDERS become more important to you

The ARMSTRONG Threading Tool takes interchangeable high speed steel form-cutters which require only flat top grinding to resharpen—always hold their true thread form.

Every rise in labor costs, every added tax, every overhead burden, every increase in cutting steel prices, every new, more costly machine tool, all increase the importance of ARMSTRONG TOOL HOLDERS to profitable operation.

ARMSTRONG TOOL HOLDERS reduce direct tooling costs to an absolute minimum—"Save: All Forging, 70% Grinding, 90% High Speed Steel."

ARMSTRONG TOOL HOLDERS reduce tooling-up time to minutes, to the selection and adjustment of the holder and cutter.

ARMSTRONG TOOL HOLDERS permit increased speeds and feeds—produce more pieces per hour per machine tool.

ARMSTRONG TOOL HOLDERS are efficient for they embody a perfection gained by over 50 years of specialization in the development and refinement of tool holders.

ARMSTRONG TOOL HOLDERS are inexpensive because they are quantity produced by modern methods, for a world market . . . are used by over 96% of the machine shops and tool rooms . . . are carried in stock for your convenience by all industrial distributors of consequence.

Buy **ARMSTRONG TOOLS** from your Industrial Distributor

Write For Catalog

ARMSTRONG BROS. TOOL CO.

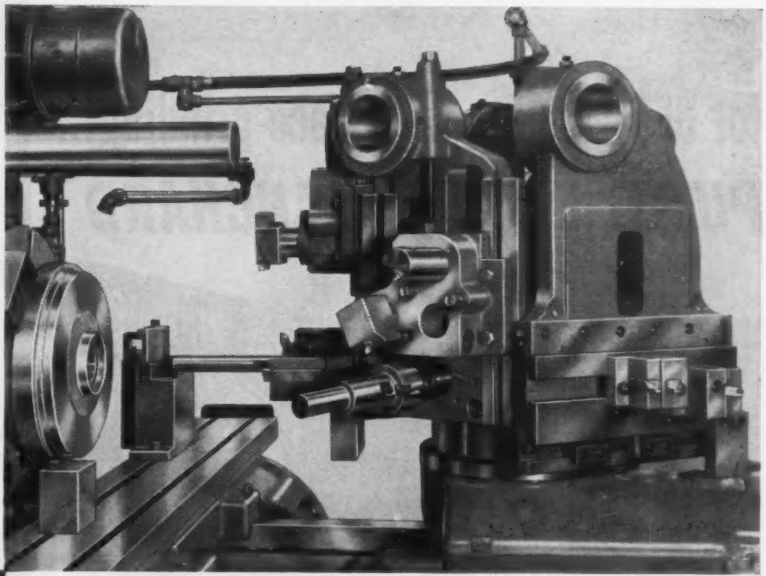
"The Tool Holder People"

5213 W. ARMSTRONG AVENUE CHICAGO 30, ILL.

"SPADE WORK" *pays off . . .* *on a*

POTTER & JOHNSTON 6DRE-40 AUTOMATIC

with P&J-ENGINEERED TOOLING

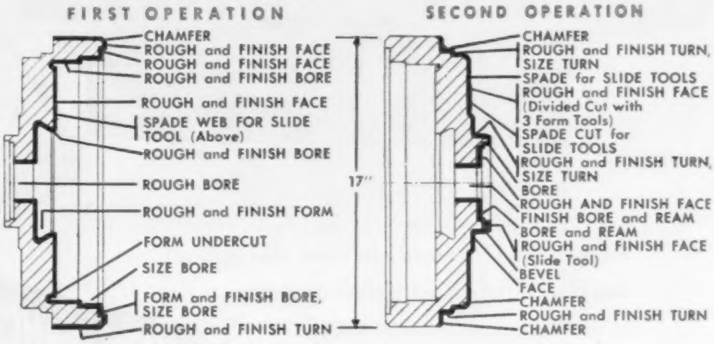


THE PROBLEM –

To machine this hard (288 Brinell) cast iron flywheel . . . requiring *48* close-tolerance cuts . . . quickly and economically.

THE SOLUTION –

Doing the job on a P&J 6DRE-40 Automatic Chucking Turret Lathe . . . with the extra power and rigidity it takes to use fast-cutting carbide tools with real efficiency. And doing the job with P&J-Engineered Tooling (see diagrams) . . . ingenious use of spade cuts followed by divided cuts with 2 or 3 slide tools operating simultaneously finished broad surfaces *fast!* First chucking (22 cuts) was finished in just 14.41 minutes . . . the second (26 cuts) in just 9.69 minutes!



HEAVY LINES INDICATE MACHINED SURFACES

Yes, in *this specific* job, "Spade Work" refers to the spade cuts used in the cost-cutting tooling set-up. But in addition, every time you put a hard-to-machine job on a P&J Automatic, you get the benefits of another, more important type of "spade work." This is the basic research and development engineering that has gone into every P&J Machine . . . gives it the ability to handle tough metals and complicated cuts with cost-saving speed and ease. And it's the engineering skill and experience that goes into P&J Tooling to insure the best possible combinations and sequences for minimum machining time. If you're interested in piling your profits higher, it's time to dig into the facts about a Potter & Johnston 6DRE-40. Write for Bulletin No. 159 or phone the Pratt & Whitney Office near you, and ask a Direct-Factory Representative to call and discuss your requirements. Potter & Johnston Company, Pawtucket, Rhode Island (Subsidiary of Pratt & Whitney Company, Inc.).

POTTER & JOHNSTON

Precision Production Tooling for More Than Fifty Years

AUTOMATIC CHUCKING TURRET LATHES

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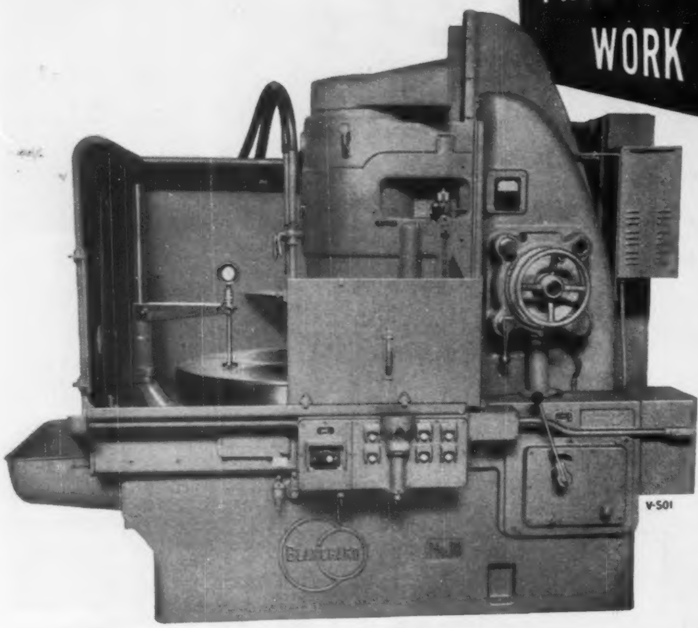
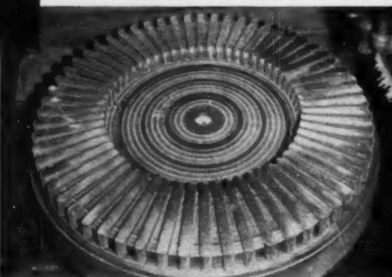
for BEST results in surface grinding...
PUT IT ON THE BLANCHARD

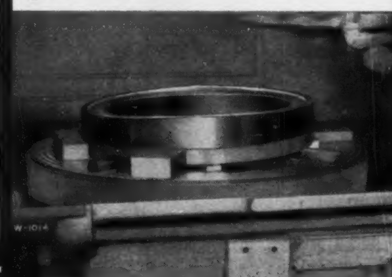


PRODUCTION WORK

SIDE PLATES. 9" x 18" plates ground from rough on No. 18 Blanchard with 36" chuck. Stock removal 1/16" to 1/8" per side. Held flat within .003", parallel to .001", and to dimension tolerance of ±.001". Production: 30 surfaces per hour.

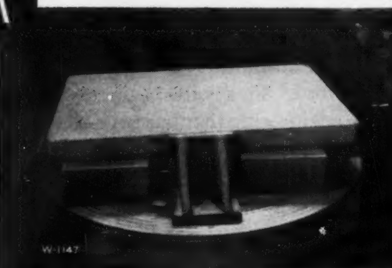


CONNECTING LEVERS. Cast iron levers ground in special magnetic fixture with pins located in "vee's". Stock removal per side is 1/32" to 1/16"; must be flat and at right angles to pins. No. 18 production: 180 pieces per hour, compared to 20 pieces per hour by former method used.



MAINTENANCE AND ODD LOT WORK

HARDENED STEEL PUNCHES. This 24-13/16" dia. punch, reground on a No. 18, is centered radially on 36" magnetic chuck. Duplicate circumferential and radial shear reliefs are generated with two setups.



GRANITE SURFACE PLATES. A No. 18 Blanchard reconditions this 18" x 34" granite surface plate by grinding it flat within .0002". 3/16" of stock is removed in 5 hours.

Blanchard Grinders are used throughout industry on surface grinding jobs that demand the utmost in production, finish and accuracy.

Whatever *you're* surface grinding, there's a Blanchard designed to do the job speedily and accurately.

PUT IT ON THE BLANCHARD

Send for free copies of "Work done on the Blanchard", fifth edition, and "The Art of Blanchard Surface Grinding".

THE BLANCHARD MACHINE COMPANY
64 STATE ST., CAMBRIDGE 39, MASS., U. S. A.

For more information fill in page number on Inquiry Card, on page 225

IN CUTTING-OFF OPERATIONS...

...SPEED WITHOUT ACCURACY

IS COSTLY!

Efficient cut-off of steel blanks from bars demands a combination of speed *and accuracy*. MARVEL, and MARVEL alone, achieves this combination with machines capable of delivering feeds and speeds which fully utilize the strength and heat resistance of the modern high speed hack saw blade.

MARVEL dual power feed and crank lever method of reciprocation are two exclusive features designed to give increased speed and efficiency. This unique dual power feed employed on the Series No. 6 and No. 9 MARVEL Ball Bearing Hack Saw Machines, simultaneously controls both positive feed depth and feed pressure, automatically adjusting both pressure and depth of feed correctly in proportion to the number of teeth in contact with the work. This automatically forces the blade to cut as deeply as possible and practical on every stroke, without demanding the attention of the operator. As a result, the work is cut-off in the fewest possible number of strokes. Quick return of the saw frame on the non-cutting stroke, accomplished by the crank lever, delivers 33⅓% more cutting strokes per minute without increasing the blade velocity on the cutting stroke.

Accuracy is assured by the construction of the machine itself. Anti-friction ball or roller bearings are used at all load carrying points. The saw frame reciprocates on fully enclosed special design ball bearings which are factory adjusted with a pre-load, assuring permanent frictionless rigidity. Saw frame, saddle, and upright are precision machined and fitted to form a rigid integral unit capable of withstanding any cutting load with no deflection or side movement.

These exclusive features found only in MARVEL Hack Saw Machines, together with the unequalled performance of the unbreakable MARVEL High-Speed-Edge Hack Saw Blade, form a team that guarantees the fastest, most accurate cutting-off.

S-1300

There is a MARVEL field engineer near you capable of intelligently discussing your cut-off work. Send for catalog C-55, and the name and address of your nearest MARVEL field engineer.

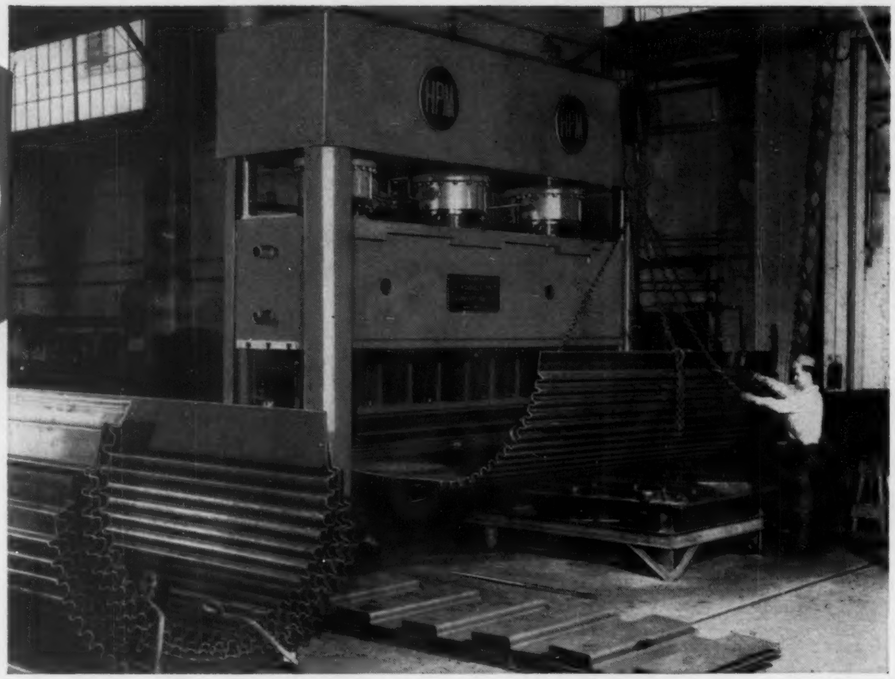
ARMSTRONG-BLUM MFG. CO.

5700 WEST BLOOMINGDALE AVE. • CHICAGO 39, ILL.

MARVEL *Metal Cutting* **SAWS**

Better Machines—Better Blades

Permanent Wave for 1/2" Plate



Special H-P-M Press Corrugates Heavy Steel Plate Annealing Boxes

For rugged, heavy duty jobs—special metal forming requirements of all types—manufacturers like National Annealing Box Co., Washington, Pa., rely on H-P-Ms. This special frame, long bed, 1500 ton H-P-M will handle steel plate up to 180" wide. Half inch plate (as illustrated) is formed into cylindrical or flat corrugated sheets which form the walls and covers of annealing boxes. These corrugations are 2" deep, well rounded for strength, formed one at a time.

For your toughest jobs choose H-P-Ms—standard and special Fastraverse, self-contained presses are easily adapted to countless applications. Call your H-P-M field engineer at the planning stage. Here's worthwhile experience for you!

Write Today!

HPM

THE HYDRAULIC PRESS MFG. CO.

Mount Gilead, Ohio, U.S.A.

A DIVISION OF KOEHRING COMPANY

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"Fantastic" you say, Mr. Herb?

MACHINERY
AUGUST 1956

Gears for This Age of Cybernetics

In the past, when most gears were of relatively coarse pitch and were used solely for the transmittal of rotary motion, the problems of designers and production men were comparatively simple. Generally speaking, all the designer had to do was to specify gears of correct ratios and of adequate strength for the intended application. The production man simply had to make the gears accurate within reasonably close tolerances.

Today, the picture is greatly different. There is a demand for fine-pitch gears of unbelievable accuracy suitable for use in the ultra-precise control equipment of rockets, missiles, radar, and various other new developments in the field of aviation. Such gears must not only transmit force but must accurately measure angular position. They must also operate without backlash at high temperatures with no lubrication and under conditions of high vibration and shock loads. Some of these requirements must also be met by gears used in digital and analogue computing machines. They are the "brains" of mechanical-electrical control devices.

Gears in these categories are being regularly made to the Class 3 precision tolerance of the American Gear Manufacturers Association which calls for a total composite error of not more than 0.00025 inch and a total tooth-to-tooth composite error of only 0.0002 inch. Some engineers believe that demands for instruments in the fields of aviation and

nuclear energy will someday necessitate that gears must meet a tolerance which would restrict the total composite error to about 0.00003 inch. Sounds fantastic!

Yet, July [illegible] that described the [illegible] ments on which the tooth spacing must be true within 5 seconds of arc, the teeth having a circular pitch of only 0.050 inch—teeth with an addendum of only 0.0159 inch. How accurate the tooth spacing must be can be visualized when it is remembered that one second of arc amounts to a rise of only about 1/4 inch in a length of one mile. Even though the pitch diameter of the gear segments is over 6 inches, the permissible error in tooth spacing is less than 0.0001 inch.

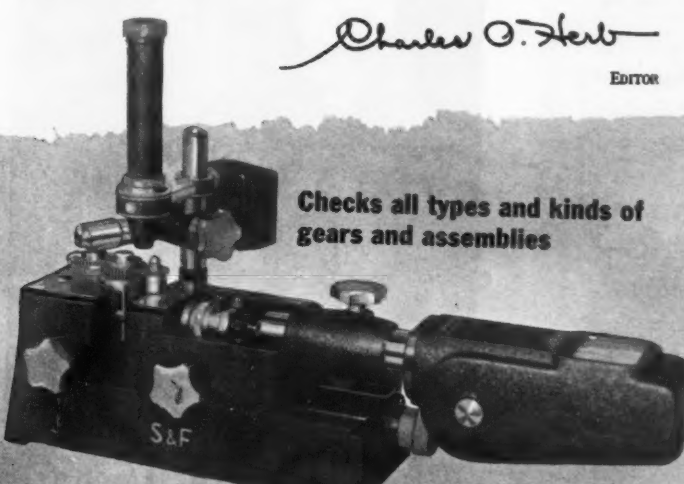
This number of MACHINERY features an article that describes the manufacture of fine-pitch gears of various types to meet stringent instrumentation requirements. Another article dealing with the application of autocollimators to determine minute errors in fine-pitch gears has been scheduled for early publication.

Truly, the production of gears for our age of cybernetics, in which control systems are tending more and more to simulate the human brain and nervous system, has necessitated a manufacturing skill that would have been inconceivable to gearmakers of bygone days.

Charles O. Herb
EDITOR

the gear tester to check such accuracy is already here—

S & F Gear Tester... guaranteed to repeat within .00002"



Checks all types and kinds of gears and assemblies

Ask for a demonstration or the name of the S & F user near you.

KO CO. INC. INDUSTRIAL IMPORTERS

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A BETTER METHOD OF MACHINING

Broach Your Helical Transmission Gears *and Cut Your Costs*

This is a 73 tooth automatic transmission gear—5.5853 P.D., 14 pitch, 20° pressure angle.

It is broached in just one pass. A single shaving operation completes it.

All critical dimensions including lead and concentricity are held to extremely close tolerances.

Broaching time	25 Seconds, **floor to floor**
Shaving time	40 Seconds, **floor to floor**
Total machining time	65 Seconds

The 7 foot Naloy Broach used also chamfers the gear tooth edges as it cuts the teeth.

The constant and intimate contact Red Ring engineers have with advanced gear practice gives them a very real advantage in the design and production of gear tooth broaches.

***Write* for specific suggestions on your broaching operations.**

SPUR AND HELICAL GEAR SPECIALISTS
ORIGINATORS OF ROTARY SHAVING AND ELLIPTOID TOOTH FORM

NATIONAL BROACH AND MACHINE CO.

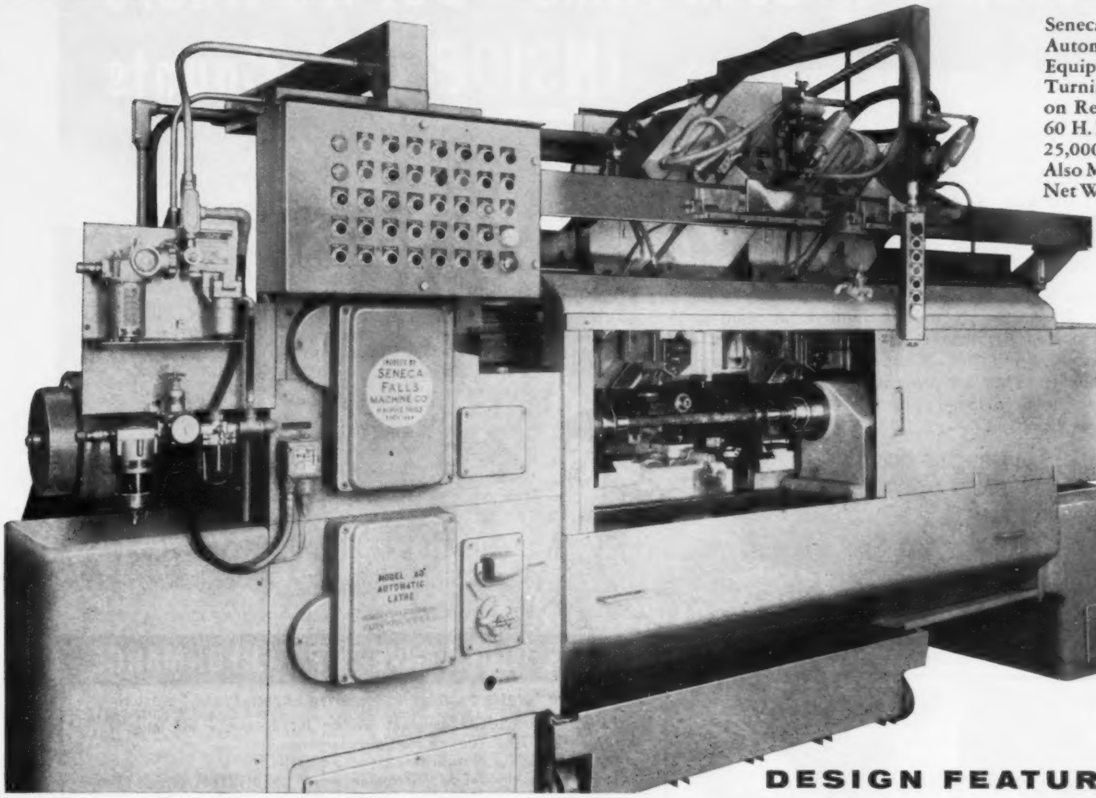
5600 ST. JEAN . . . . DETROIT 13, MICHIGAN

7332

WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT

For more information fill in page number on Inquiry Card, on page 225

A BETTER METHOD OF MACHINING REAR AXLE, AND OTHER SHAFTS



Seneca Falls Model AQ Automatic Lathe Equipped for Stem End Turning Operation on Rear Axle Shaft. 60 H. P., Net Wt. 25,000 Lbs. Also Model LQ, 30 H. P., Net Wt. 20,000 Lbs.

● The new Models LQ and AQ Seneca Falls Automatic Lathes are designed to combine the best and fastest methods of rough and finish turning shafts on a single machine without removing the work and without attention on the operator's part.

The line drawing shows a machining operation on the stem end of a rear axle shaft which is rough turned with multiple tools on a rear carriage while finish turning is done with single, tracer-controlled tools on each of the two overarm carriages. Thus the advantages of multiple tooling for stock removal and single tool tracer turning for accurate finish operations are combined. By this method extremely close tolerances are maintained since the pressure of the single tool is constant over the entire length of the work piece, and full advantage can be taken of the higher cutting speeds now possible with the newer carbide and oxide tool materials.

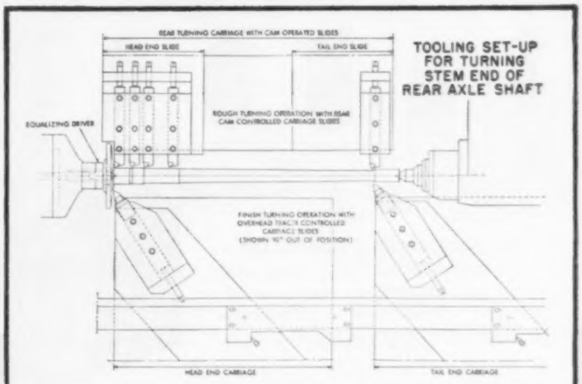
The machining operation is completely automatic . . . the operator loads shafts between centers and pushes the starting button; multiple tools rough turn; tracer tools then finish turn; and finally the machine stops with all tools returned to starting position.

A similar type lathe is used for the flange turning operation. Varying application of multiple tooling or single tracers to either rear or overarm carriages is possible on these lathes and complete "in line" automation can be engineered to specific production requirements,

Seneca Falls Machine Co., Seneca Falls, N. Y. Write for Bulletin Q-56-B

DESIGN FEATURES

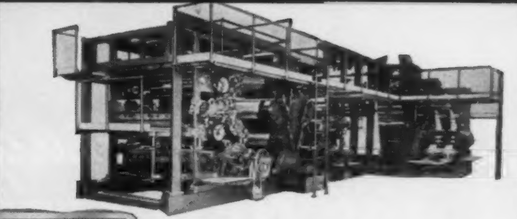
- **Simplified changeover features for reduced set-up time.**
- **Feed rate may be automatically changed during cutting cycle.**
- **Streamline design for efficient chip guarding.**
- **Screw feed to all carriages.**
- **Four speed head with automatic change-over.**
- **Large chip flow area.**
- **All templates clear of chip area.**
- **All ways hardened, ground and replaceable.**
- **Open front design facilitates loading and unloading.**
- **Straight line diameter adjustment for tracer tools . . . no shoulder length change to correct.**

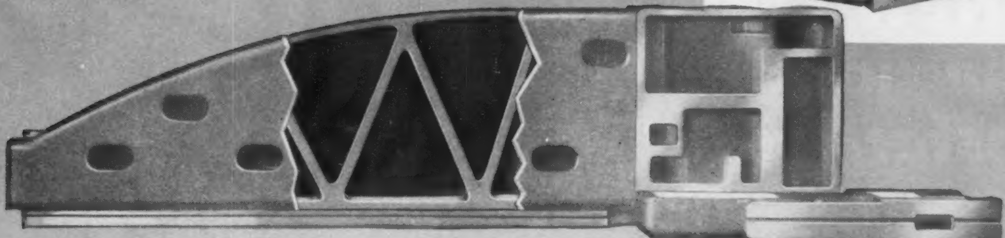


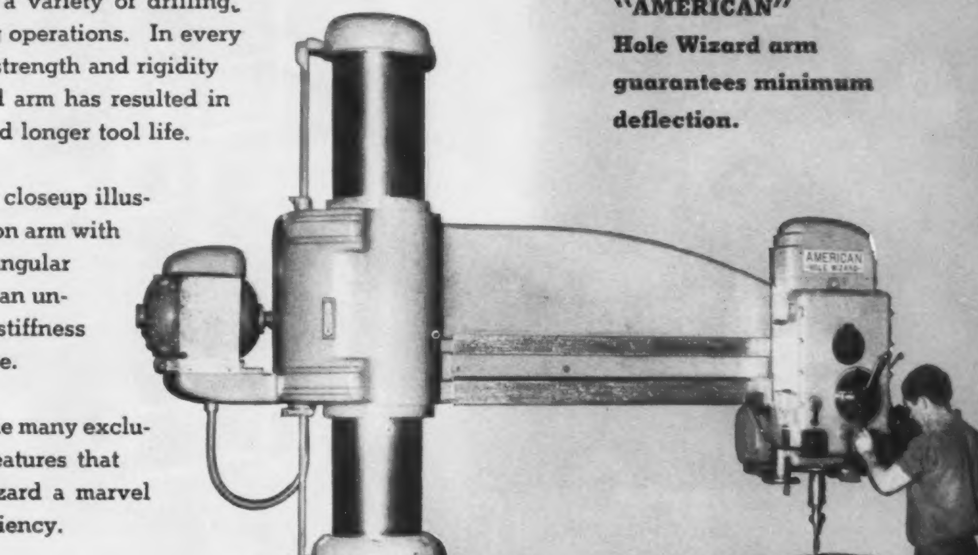
NEW SENECA FALLS

MODEL LQ AND AQ AUTOMATIC LATHES

For more information fill in page number on Inquiry Card, on page 225

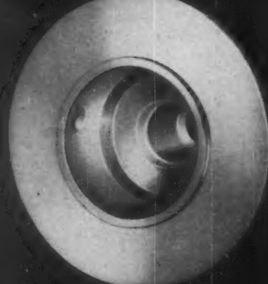




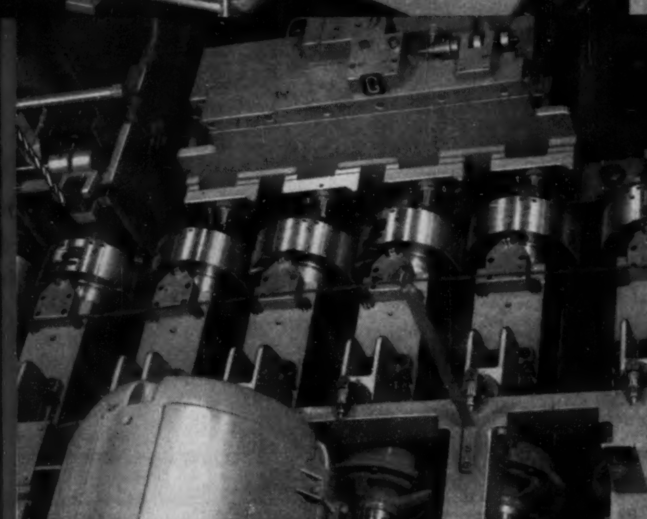


Announcing the NEW Cross Chucking Transfer-matic

Pat. No. 2,745,167

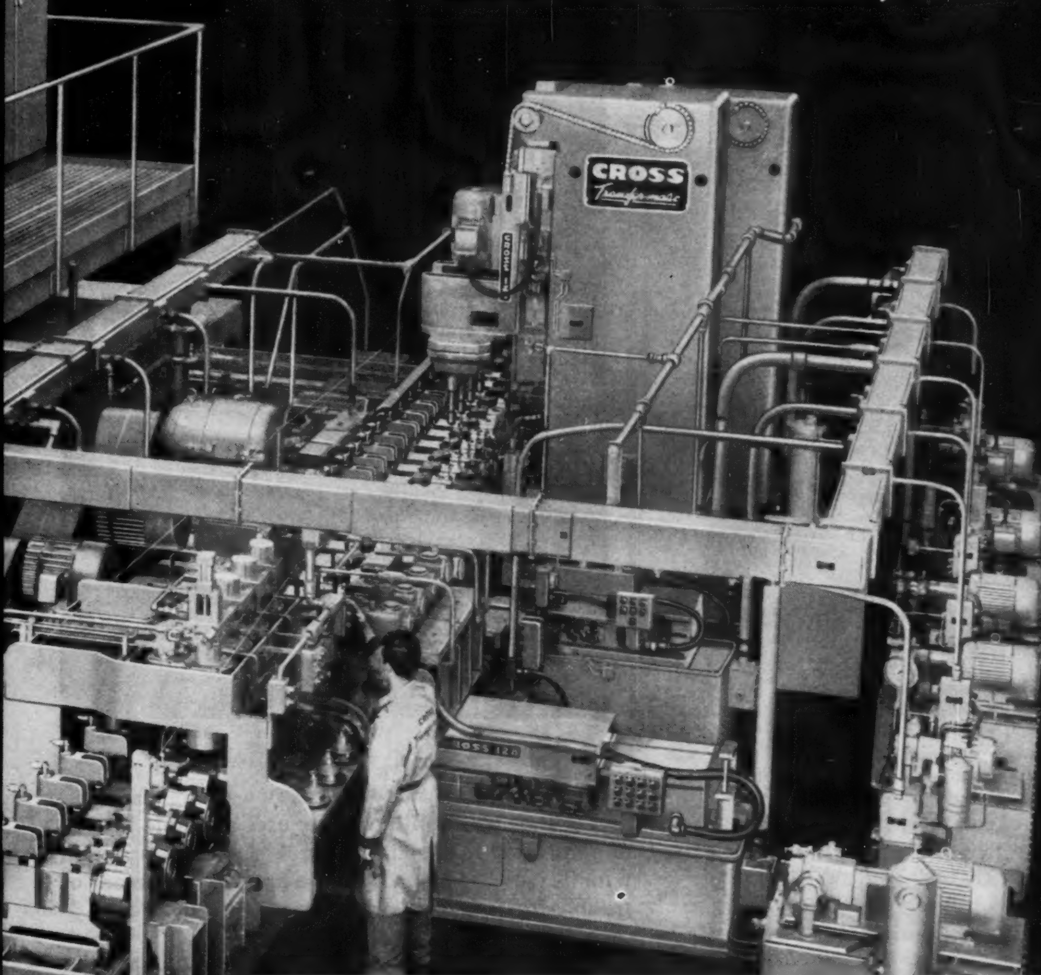


Station 1



Station 4

Another Automation First by Cross



A completely new development! That's the Cross Chucking Transfer-matic . . . the first chucker ever built on this principle. Standard Cross "building block" construction makes provision for any reasonable number of stations and work pieces up to 48" in diameter.

This particular seven station Transfer-Matic, created for differential gear cases, has a rated capacity of 368 pieces per hour at 100% efficiency.

An unusual feature is that the work pieces are chucked and not released until all operations are complete. The chucks are mounted on precision spindles, which in turn are carried on pallets—four to the pallet. There are ten pallets—one at each station and three on the conveyor moving from Station 7 to Station 1.

Operations are: Station 1, four pieces positioned in work holding chucks by loading mechanism and clamped automatically. Station 2, pilot diameters turned and side gear pockets bored. Station 3, spherical seats generated. Station 4, flange faces and thrust faces for side gears generated. Station 5, pin hole for pinion shaft drilled after spindles are indexed into pre-determined position and locked to prevent rotation. Station 6, pin hole chamfered top and bottom. Station 7, pin hole rough and finish reamed with shuttle head.

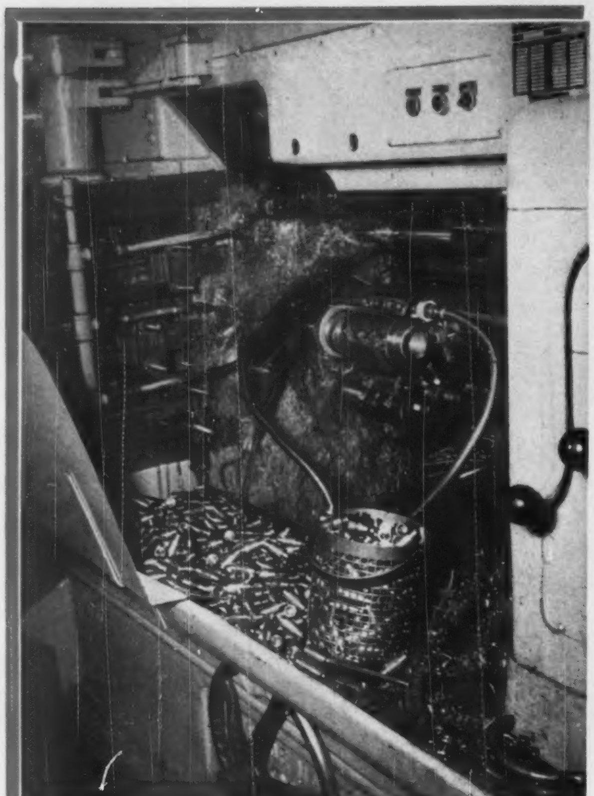
Features include construction to JIC Standards, hardened and ground ways, interchangeability of all parts, pre-set tooling and programmed tool changes with the Cross Machine Control Unit.

Established 1898

THE **CROSS** CO.

First in Automation

DETROIT 7, MICHIGAN



Better Machining from stock to finish

for Blackstone Corporation, Jamestown, New York

The nation's oldest manufacturer of washing machines, dryers and ironers, Blackstone, uses a sizable battery of automatics for its machining. For years, lubrication with Texaco has helped achieve an enviable record of trouble-free production with economical unit costs.

Dual-purpose *Texaco Cleartex Oil AX,* for example, is used in automatics as cutting fluid and machine lubricant. The results—extra-long tool life, consistently rust-free finish, lasting undiluted strength of the cutting oil, effective protection for machines.

There is a complete line of *Texaco Cutting, Grinding* and *Soluble Oils* to help you do *all* your machining better, faster and at lower cost. Let a Texaco Lubrication Engineer help you choose the ones best suited to your needs. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write:

The Texas Company, 135 East 42nd Street, New York 17, N. Y.

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TEXACO CUTTING, GRINDING, SOLUBLE AND HYDRAULIC OILS

For more information fill in page number on Inquiry Card, on page 225

* New Congress
* New Defense Program
* New Prosperity

Keeping up with Washington

By Loring F. Overman

WHEN the Eighty-Fifth Congress is called to order on January 3, four years of new problems and controversy will lie ahead. Demands for tax reduction will be loud and long—but little heeded. Labor leaders will again press for repeal of the Taft-Hartley legislation, with business opposing. The "let's-cut-government-expenses" movement will be all but submerged by the rising tide of government expansion into more and more activities that affect greater numbers of voting citizens.

During the formative period of the Eighty-Fifth Congress, its members will be particularly receptive to the voices of constituents. Industry men will find Washington and Capitol Hill a "must" for study, contact, and correspondence in the weeks ahead.

New Defense Program

Preliminary estimates are that the defense program for fiscal 1958 will cost $39,000,000,000—about $2,000,000,000 more than the total for the 1957 fiscal year. The added cost is due to greater emphasis on "new" weapons, such as guided missiles of all sizes up to intercontinental range; planes of supersonic speed; atomic navies; and completely airborne armies.

The Defense Department has formally terminated its machine tool mobilization base policy established June 30, 1955. The program called for a billion dollar pool of machine tools to be acquired over a ten-year period. Termination of the program (Defense Department Instruction No. 4005.10) followed an earlier decision that a stockpile of machine tools would be less practicable, in the event of an attack, than production lines in place and operating.

The Business and Defense Services Administration has also been interested in determining how much the machine tool industry would expand if encouraged by reopening of expansion goals and of tax amortization inducements. In a survey, BDSA has asked machine tool companies whether they would expand if so encouraged, the extent of such expansion in dollars, and the nature of the proposed expansion.

The decision to proceed with the construction of two more atom-powered ships—a merchant ship and a cruiser—opens new fields for machinery people who serve the maritime industries. Assuming these vessels will be as successful as nuclear submarines, gradual reconstruction of our entire navy and portions of our merchant fleet seems inevitable.

The release by the Atomic Energy Commission of fifty-six patents involving industrial use of the atom is another development. Firms or individuals wishing to apply for use of the patents should communicate with the Chief, Patent Branch, Office of the General Counsel, Atomic Energy Commission, Washington 25, D. C.

Further evidence of the atom's place in tomorrow's planning may be found in a recent announcement by the Export-Import Bank. Joining with the Atomic Energy Commission in an announcement, the bank indicated that it will make loans for nuclear-power projects abroad on generally the same conditions as those applying to conventional power systems.

New Prosperity

Washington observers figure that the economic trend will be upward for years ahead. Their conclusions are based on the coming atomic change-over in defense and civilian fields and on the increase and mobility of the civilian population. Nuclear power, among other things, will move industries and populations to new sites and thus bring demands for goods and services.

Population estimators predict one-third more people in this country within twenty years, representing a vast new market for machines and the things machines make. A springboard for these optimistic estimates was the marked rise in economic activity noted during the closing months of 1956.

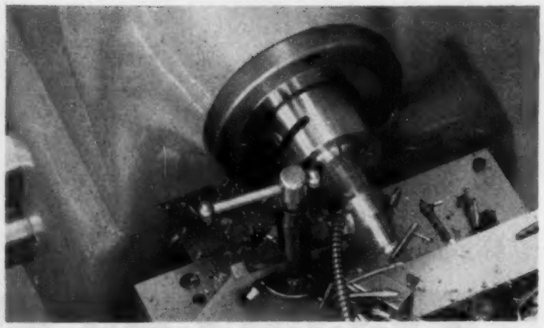
Steel production reached 99 per cent of rated capacity during September and, during October, promised to exceed 100 per cent. This high production again gives rise to speculation that the steel industry may be successful in its efforts to secure permission to expand facilities under rapid amortization privileges.

Washington Briefs

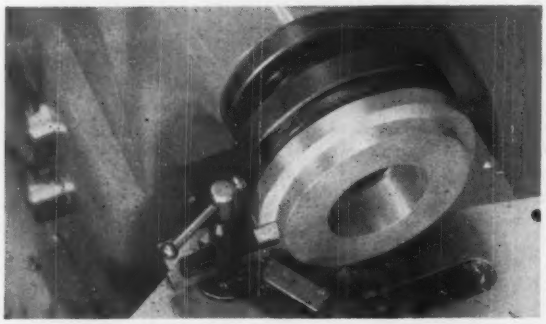
* The Office of Defense Mobilization has announced that it will not stockpile nickel during the first quarter of 1957 so that the entire supply will be available to industry. ODM Director Flemming indicated that negotiations are nearing completion which will add 140 million pounds annually to the supply. Current requirements of military and atomic energy uses amount to some 84 million pounds.
* The Defense Department has eliminated its quota system designed to conserve nickel, cobalt, chromium, columbium, molybdenum, and tungsten in the manufacture of aircraft gas turbine engines. A simplified reporting system has replaced the quota plan.
* Underground defense plants can now be protected by a warning system perfected by the Army Signal Corps. This device detects any atomic or hydrogen bomb explosion endangering the installation, trips relays which sound warning horns, closes doors, shuts off gas lines, starts filtered ventilating systems, and actuates other protective measures.

HARDINGE
ELMIRA, N.Y.

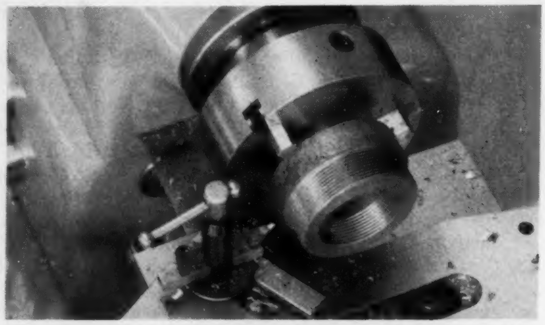
"The Outstanding Tool Room Lathe"



Precision Collet work for all sizes to 1 - 1/16" Collet seats *directly* in spindle.



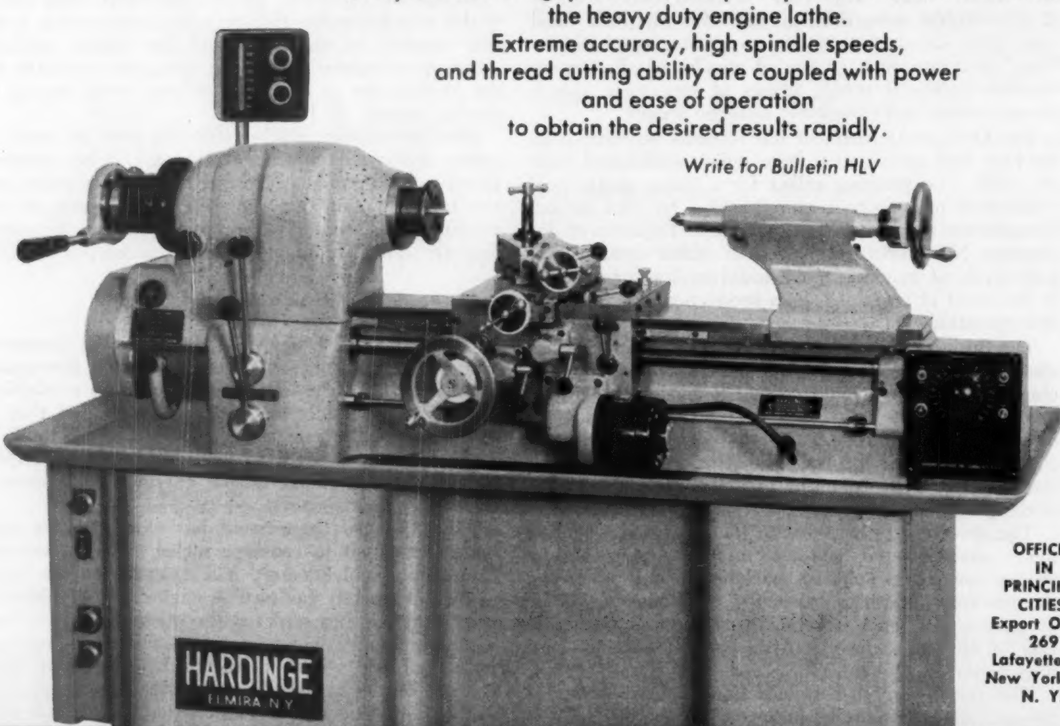
Precision Step Chucks for diameters up to 6". Provides Collet-like accuracy.



Integral Mount Jaw Chucks for precision holding of regular or irregular shapes up to 5".

Hardinge Model HLV 10" Lathe was primarily designed to fill a very old existent gap between the plain precision bench lathe and the heavy duty engine lathe.
Extreme accuracy, high spindle speeds, and thread cutting ability are coupled with power and ease of operation to obtain the desired results rapidly.

Write for Bulletin HLV



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HARDINGE BROTHERS, INC., ELMIRA, N. Y.

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"Do As I Tell You"—Not the Way to Develop Able Assistants

MANY executives, from the foreman in the shop to the president in his leather-upholstered chair, experience difficulty in developing capable assistants. Their failure is often due to an inability to properly delegate authority and responsibility to the men under them—the men whom they expect to carry out specific duties.

Mastering the art of work delegation requires patience and earnest effort, according to John J. Corson, partner of the management consultant firm of McKinsey & Co. This expert has pointed out that in order to build a truly decentralized organization that succeeds by getting initiative, self-discipline, imagination, and loyalty out of his associates, the executive must demonstrate four important personal attributes:

1. He must be receptive to other people's ideas, have a minimum of NIH (not invented here!) factor in his makeup, and be able not only to welcome the ideas of others but to plant his own ideas in the minds of others and to compliment them on their ingenuity.

2. He must be sufficiently placid to see others make mistakes and to charge the cost to an eminently worth-while investment in the development of his most valuable resources—people.

3. He must be willing to forego the luxury of blowing his top, of berating his assistant. To delegate authority requires that the boss limit his criticism of the individual who tries but fails. Excessive criticism may discourage the individual from trying again to make use of the authority delegated to him.

4. He must be able, if he knows much about the details of the business, as he probably does, to exercise great self-restraint. He must be satisfied with exercising only broad controls over results and refrain from telling the sales manager how to sell or the controller how to keep accounts—no matter how expert he may have been in either field.

Persons in a position of authority—foremen or presidents—who learn to delegate responsibility on an intelligent foundation, such as outlined, should find it comparatively easy to build up a trustworthy and able corps of assistants.

Out on the Pacific Coast there is an airplane company that realized, several years ago, the importance of developing a corps of executives to the point where there would be someone capable of filling any executive position at a moment's notice. Since then men are being constantly trained, three deep, for every executive job in the organization.

Recently a new division was established within the company. Twenty-six top-notch executives were taken out of the older plant, without lessening operating efficiency, because fully capable replacements were ready to step into the shoes of the men who had been transferred to new assignments.

Read all about this intensive executive training program on page 144 in this number of MACHINERY.

Charles O. Herb
EDITOR

What's New

IN STEEL FROM STOCK

In the news today are many developments of interest to those who specify, buy or work with steel. Ways in which you can raise efficiency and lower costs in your operations may be suggested by the following summary.

NEW IN RYERSON STOCK—Cold finished Ledloy hexagons in sizes up to 3". (Previous maximum size: 1½".)...Welded, square, structural tubing with a lighter wall. Advantages: Costs less yet has all the strength, good surface, etc., needed for ornamental applications.

NEW TYPE 202 STAINLESS NOW AVAILABLE FROM RYERSON—Pioneering with a new type of stainless steel, Ryerson now offers Type 202 sheets, No. 2B and No. 4 finishes in popular gauges and sizes, for quick shipment from stock. Since nickel may continue in short supply for some time, interest in this new stainless has been strong. Reasons: Type 202 contains only half as much nickel as Type 302 yet compares favorably with 302 in corrosion resistance, fabricates as readily as 302 and costs 2¼¢ per lb. less.

WHAT ABOUT HOT ROLLED BARS? A leading metal-working publication recently listed hot rolled carbon steel bars as a hard-to-get product—but this is not the case when you draw on Ryerson stocks. Our inventories of hot rolled bars have seldom been better, both as to tonnage and size range.

NEW, ACCURATE I.D. ON CYLINDER TUBING FROM STOCK—In hydraulic cylinder applications, the I.D. is the critical tubing dimension. Yet, until now, buyers of tubing from warehouse stocks could specify only O.D. and wall—and wall thickness may vary as much as plus or minus 10% under standard manufacturing tolerances. As a result, I.D. dimensions could vary so widely that tubing was not suitable for cylinder use. But now buyers may specify both O.D. and I.D. when ordering cold drawn seamless tubing from Ryerson (in 2" through 9" O.D. sizes)—thus assuring the accurate I.D. dimensions needed for cylinders. We believe we are the only warehouse to carry this stock.

REPORT ON NEW E-Z-CUT PERFORMANCE—New proof of the quality of Ryerson's leaded plate steel, New E-Z-Cut, was reported by company which recently made a mold for a miniature tire. Some of the tiny lands forming the tread design were only .015" thick but $30 worth of New E-Z-Cut took the risk out of the $4000 machining job. Because New E-Z-Cut is remarkably clean and free of excessive stringers, even the finest lands of the mold were sharp and true. Because New E-Z-Cut machines up to 30% faster than mild steel, the difficult job was completed in record time. High finish made the mold easy to prepare for plating.

FLUID LINE TUBING WITH IMPROVED FINISH—Another new Ryerson product is Hydra-Luster hydraulic fluid line tubing which has an unusually beautiful finish, free from scale and surface defects because of a new method of atmospherically controlled annealing. This tubing is on hand in all sizes through ¾" O.D. x 16 gauge wall.

PVC PLASTIC PIPE IN LARGE DIAMETERS—8" and 10" pipe in both schedule 40 and 80 have been added to growing Ryerson stocks of the remarkably anti-corrosive plastic—Ryertex-Omicron polyvinyl chloride. Also available: smaller size of pipe, fittings, sheets and rods. For complete data on properties, resistance to more than 300 chemicals, etc., write for technical booklet 80-3.

RYERSON CERTIFIED QUALITY

JOSEPH T. RYERSON & SON, INC. PLANTS: NEW YORK • BOSTON • WALLINGFORD, CONN. PHILADELPHIA • CLEVELAND • CHARLOTTE • CINCINNATI • DETROIT • PITTSBURGH • BUFFALO CHICAGO • MILWAUKEE • ST. LOUIS • LOS ANGELES • SAN FRANCISCO • SPOKANE • SEATTLE

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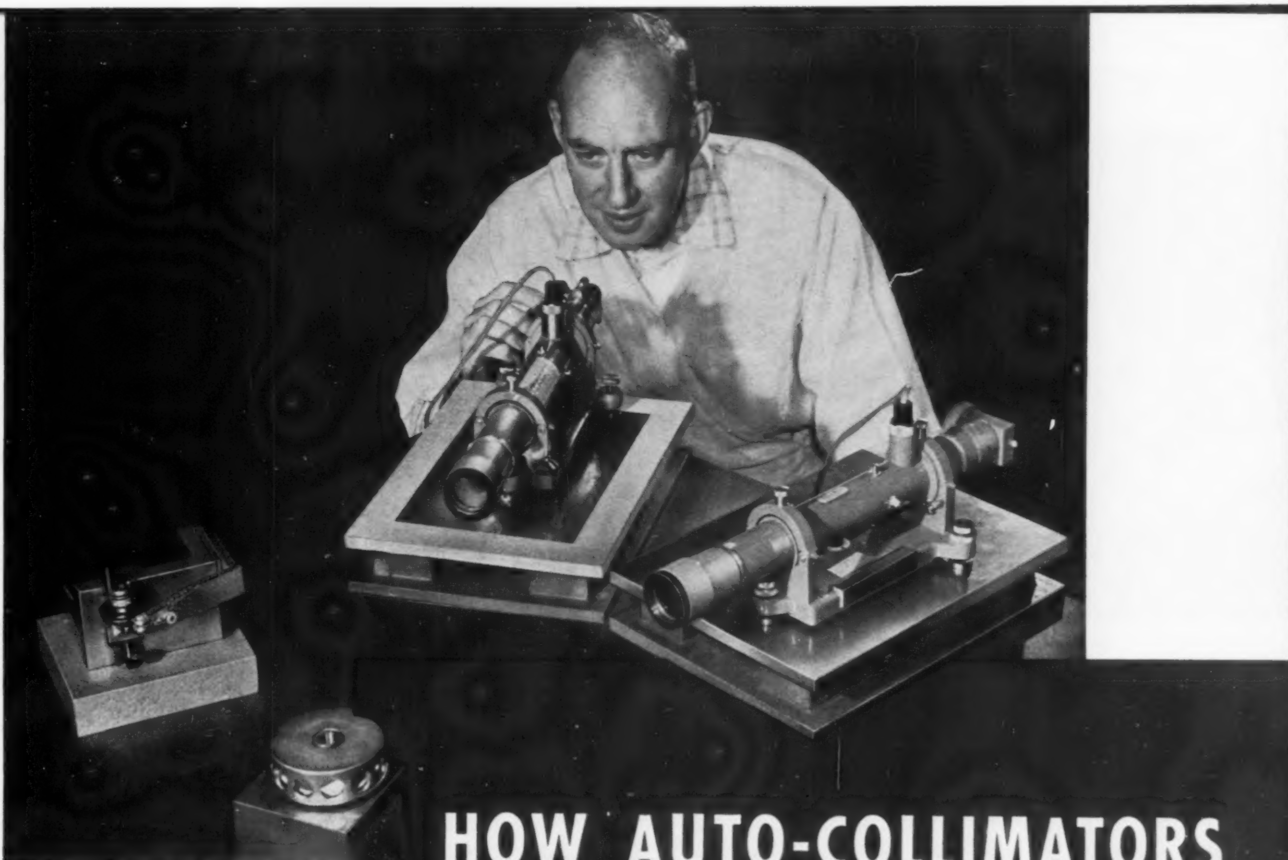

HOW AUTO-COLLIMATORS MEASURE GEAR ERRORS

Optical equipment in use in one of the special weapons laboratories of Northrop Aircraft measures directly errors in gears and gear trains in seconds of arc.

By T. R. KNOWLES
Research Engineer
Northrop Aircraft, Inc.
Hawthorne, Calif.

THE function of a gear mesh is to transmit angular rotation from one shaft to another in accordance with a simple mathematical relation that can be expressed as:

$$\theta_2 = k\theta_1 + c$$

where,

θ_1 = angular displacement of one shaft from some arbitrary position;

θ_2 = corresponding displacement of a second shaft;

k = proportionality factor (usually considered constant) termed the gear ratio;

c = constant which depends on initial conditions.

The constancy of k, with which this article is concerned, is often of paramount importance to precision gearing. For example, in the field of

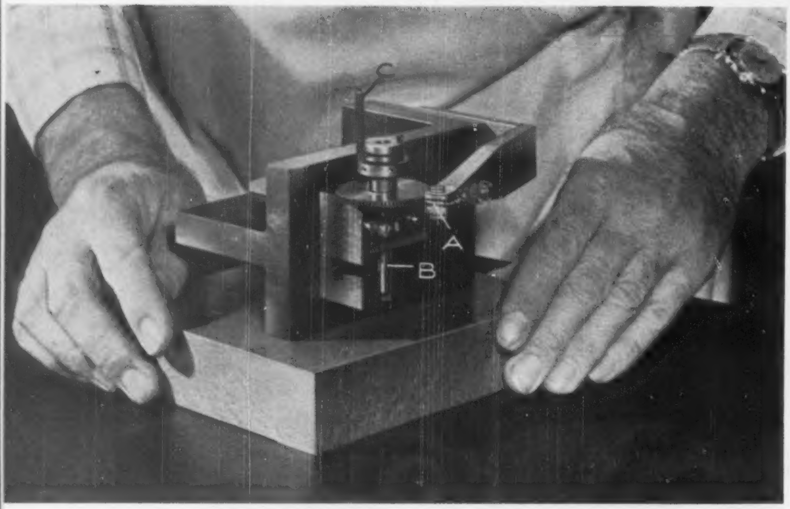

Fig. 1. To inspect the gear, the fixture includes an indexing device and an adjustable mirror.

electronics, motor-like electrical units called resolvers can sense angular displacements of 10 seconds or less. Only the most accurate gears—those with a gear ratio k that remains constant to the degree required—can transmit with fidelity angular movements of this order. It is unfortunate that under present industrial gear standards this fundamental criterion of gear quality is only loosely controlled.

Careful study has been given to the calculation of gear inaccuracies, utilizing the traces taken by the popular variable center-distance fixtures. Solutions derived in this way have their limitations. In the first place, ordinarily, there is no proof that the master gear involved in the trace is free of significant errors or that the trace itself is free of test fixture, bearing, arbor, or amplifier errors. Secondly, noncyclic, or random, errors cannot be estimated readily from variable center-distance traces, or be reduced to formula. Finally, any shaft or bearing eccentricities cause confusion.

Two Watts auto-collimators are shown in the heading illustration. These instruments measure small angles directly in split seconds. In the foreground is an optical polygon, used here as a 30-degree standard. An angle-block set (not shown) is also needed to supply standard angles to which the auto-collimators can be normalized, or zeroed. To the left of the polygon on the granite surface plate is a gear-holding fixture.

This fixture, shown in close-up view in Fig. 1, plays a major role in the measurement of single gears. An interference pawl A has an action that may be likened to an errorless master gear operating with zero backlash. The fixture body and pawl linkage are made of low-expansion material, and, of course, measurements are made under close temperature control. A rigidly mounted flat spring serves as a hinge for the pawl and supplies the required pawl pressure.

A lapped gear-shaft B rotating in a V-block assures that the gear will not be charged with bearing errors. There is a mirror C atop the gear. It has an adjustable base, permitting the mirror to be paralleled to the gear-shaft. Since some measurements can be made more easily with a double-faced mirror, a selected gage-block provides an ideal reflecting surface. Once positioned, the mirror need not be touched in a complete analysis of a gear. Alignment with the auto-collimators is obtained by adjusting the fixture on the surface plate.

Errors Caused by Pitch-Circle Eccentricity (Runout)

In Fig. 2 is a drawing of a 60-tooth gear which is indexed by an interference pawl. Nominal tooth spacing is 6 degrees, the circular pitch subtending 6 degrees around C_P, the center of the pitch circle. The gear, however, rotates around axis C_R. If the pawl is released and the gear rotated clockwise one tooth, it will be seen on inspection that the gear rotates *less* than 6 degrees around C_R; in other words, there is a deficiency of rotation.

As rotation proceeds clockwise, tooth by tooth, deficiency is built up with each step until T (tooth) 15 indexes under the pawl. Although one-fourth of its teeth have been indexed under the pawl, the gear has rotated much less than 90 degrees.

In the continuing rotation beyond T 15, each step is greater than 6 degrees. When T 30 indexes under the pawl, the deficiency has been

canceled, and the gear has rotated exactly 180 degrees. Actually, this pitch-circle runout has caused no error of position if one were concerned only with T 30 and T 60. (Not true, of course, for gears operating at fixed-center distances.) Diameter T 30–T 60 may therefore be termed the *diameter of zero error*, and the diameter at right angles (T 15–T 45) termed the *diameter of maximum error*.

Rule 1. Eliminate pitch-circle runout errors by shifting the gear bore along the diameter of minimum (or zero) error.

Rule 2. Calculate the distance d (Fig. 2) from the equation:

$$d = R \times \tan 1 \text{ second} \times \frac{a}{2};$$

where,

R = radius of pitch circle;
tan 1 second = 0.0000048 (0.000004848+);
a = error in seconds observed by auto-collimator in diameter of maximum error.

Diameters of maximum and minimum error can be logged in a very short time. As can be seen in Fig. 3, only one auto-collimator is used for this measurement. After the auto-collimator has been aligned with the surface plate, the gear-holding fixture is moved to pick up the reflected image. The mirror is then adjusted so that it is parallel with the gear-shaft.

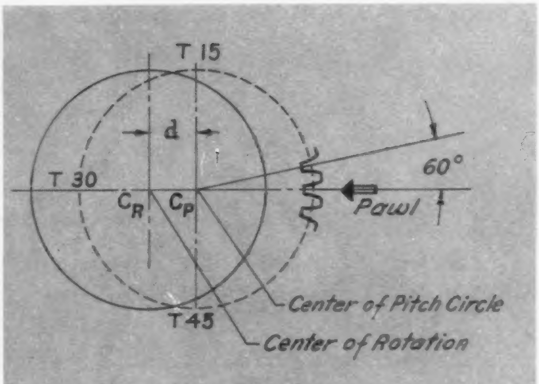

Fig. 2. This drawing of a 60-tooth gear illustrates its large pitch-circle runout.

Next, practice for repeatability of indexing is made. A 2-second spread in readings upon many returns of the pawl to the same tooth is considered good. The error reading is taken in two steps: (1) the image is zeroed from one side of the gage-block; and (2) the gear is indexed one-half the total number of teeth, and the displacement of the new image is read. The horizontal displacement represents the error of that diameter. Just what is seen in the auto-collimator in each of these steps is illustrated in Fig. 4.

In logging diameters of maximum and minimum error of a 72-tooth, 48-pitch, commercial

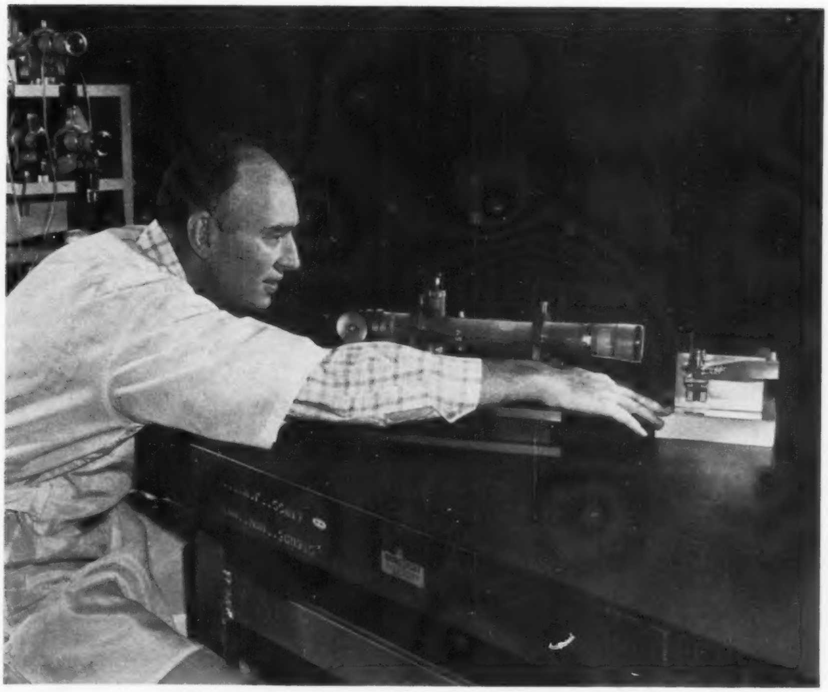

Fig. 3. One auto-collimator quickly logs diameters of maximum and minimum error.

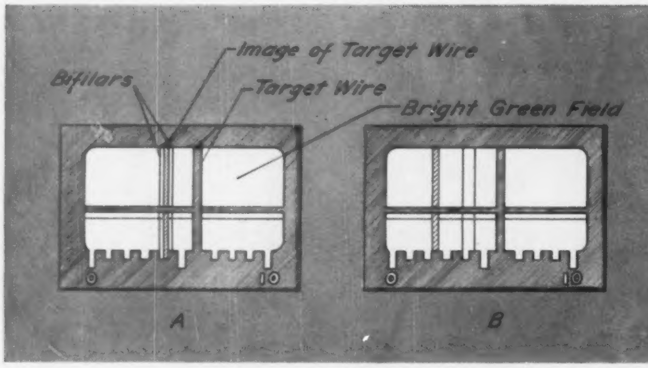

Fig. 4. Views through the auto-collimator eye-piece show the image after being straddled by the bifilars (view A) and displaced about 1 1/2 minutes to the left (view B). The exact number of seconds of displacement can be dialed.

brass gear with the setup in Fig. 3, these readings were taken:

	Tooth Range	Horizontal Displacement (Seconds of Error)
(1)	T 36 to T 72	300 seconds*
(2)	T 38 to T 2	285 seconds
(3)	T 34 to T 72	330 seconds
(4)	T 30 to T 66	345 seconds
(5)	T 33 to T 69	348 seconds
(6)	T 32 to T 68	330 seconds†
(7)	T 53 to T 17	1 second
(8)	T 55 to T 19	66 seconds
(9)	T 54 to T 18	on target

* Such a large error prompted the inspector to suspect that this initial reading was near the diameter of maximum error, so he continued close by.

† The inspector here concluded that he had bracketed the maximum error [fifth reading], and so he shifted to a region 90 degrees away for the diameter of minimum error.

Applying the equation stated previously,

$$d = R \times \tan 1 \text{ second} \times \frac{a}{2}$$

$$d = 0.750 \times 0.0000048 \times \frac{348}{2} = 0.00063$$

the bore thus had to be moved about 0.00063 inch toward T 53 and T 54. The gear was rebored and mounted on an over-size shaft, after which none of six equally spaced diameters inspected had an error greater than 45 seconds or less than 20 seconds.

The question arises as to a method of measuring the pitch-circle runout of odd-tooth gears. For such gears, the setup requires two auto-collimators, the correct angle-block, and a single-faced mirror.

Determining Random Errors

In addition to a 360-degree sinusoidal error, gears have lesser cyclic errors and, unfortunately, they have noncyclic, or random, errors that may be large. An extra-wide tooth or a group of teeth spanning less than the nominal arc would have errors of this nature. For example, in the rebored commercial gear just considered is a group of six teeth compressed into an arc of 108 seconds less than the nominal 30 degrees. Indexing tooth to tooth disclosed successive deficiencies of 20, 2, 29, 21, 6, and 30 seconds. This six-tooth zone was bracketed between zones of moderate surplus movement.

A typical specimen will illustrate the procedure used in examining for random errors and pitch-circle runout at the same time. The gear is aluminum, 120-tooth, 96-pitch, 20-degree pressure angle, and of Class 3 precision. The setup employed is like that in the heading illustration. Two auto-collimators are zeroed on a 30-degree standard, so that angles within a few minutes of 30 degrees can be read to an accuracy of plus or minus 1 second. The polygon is then set aside and the gear fixture is moved in.

In Fig. 5 are shown the results of the measurements taken with this auto-collimator setting. Obviously, twelve steps are required to encompass the gear. The values outside the circle are tooth numbers; those within the circle are the errors observed directly on the auto-collimator for the respective sectors. To obtain the error in the sector T 10 to T 20, for example, the pawl of the gear-holding fixture is engaged in T 10, and fixture is adjusted on the surface plate until the mirror is zeroed on the auto-collimator seen directly in front of the inspector.

Next, the pawl is released and engaged with T 20, and the seconds of deviation from 30 degrees read directly on the auto-collimator. The plot shows that the rotation T 10 to T 20 fell short of 30 degrees by 55 seconds. Also, a study of the plot indicates that the diameter of minimum error is approximately T 40—T 100, and the error of the diameter of maximum error indicates that the gear bore should be shifted about 0.00024 inch toward T 40.

Further examination reveals an error of closure in the plot. In balancing the sum of the deficiencies against the sum of the surpluses, a circle of 11 seconds less than 360 degrees results.

With perfect indexing, deficiencies under 30 degrees should exactly cancel surpluses above 30 degrees. A closure error of 15 to 20 seconds would call for a repeat run.

To measure tooth-to-tooth error, that is, to find out if the teeth are of correct width, requires the arrangement shown in Fig. 6, in which the auto-collimators are nulled to a 3-degree standard. The sector of the gear from T 20 to T 30, plotted in Fig. 5, logged as follows:

Tooth Range	Horizontal Displacement (Seconds of Error)
T 20 to T 21	2 seconds deficiency
T 21 to T 22	23 seconds deficiency
T 22 to T 23	on target
T 23 to T 24	on target
T 24 to T 25	1 second surplus
T 25 to T 26	9 seconds deficiency
T 26 to T 27	18 seconds deficiency
T 27 to T 28	6 seconds surplus
T 28 to T 29	8 seconds deficiency
T 29 to T 30	11 seconds deficiency
Total	64 seconds deficiency

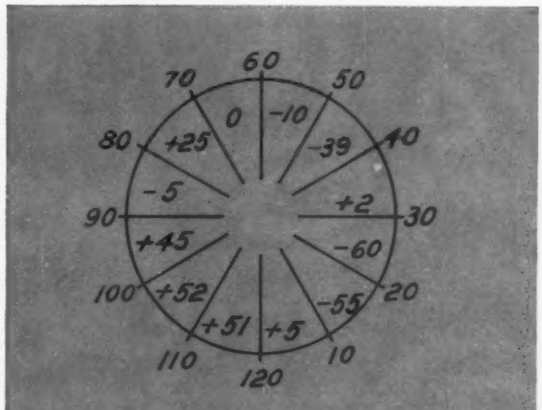

Fig. 5. The plot shows the values in each of twelve sectors of a 120-tooth gear.

This closure, showing only a 4-second spread between the ten-step method (Fig. 6) and the one-step method (heading illustration), is quite satisfactory. It is not unusual, because with the correct indexing technique, a surplus in one tooth will unfailingly be transmitted as a deficiency in the next. Thus, if y represents the maximum pawl misplacement in any step of a series, then $2y$ is the greatest error that can accumulate in that series.

This completes the explanation of checking individual gears, except for measuring errors of tooth profile. The profile error, which in any but the finest pitch gears gives considerable "flick" to the needle of a variable center-distance recorder, is considered in the following gear-train studies.

Errors in Gear Trains

The total composite error in a train of gears is the summation of gear errors, shaft and bearing errors, assembly errors, and sometimes backlash errors—each modified in value as its phasing

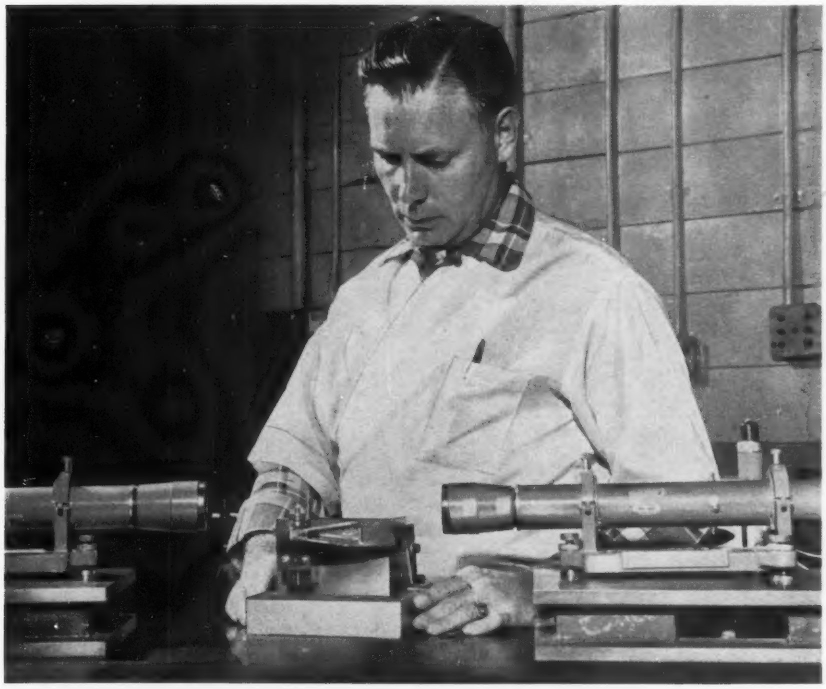

Fig. 6. Two auto-collimators are employed to measure the width of the gear teeth.

merits. For simplicity, it will be assumed that angular error is measured on the slowest shaft, and a bias torque is present to nullify the backlash.

The over-all accuracy of gear-train measurements is less than that of a single gear, as attested to by the greater spread found in repeat runs and by greater closure errors. Some of the variables appearing only in gear trains are: (1) center-distance changes as gear-box temperature changes; (2) wander of the shafts within the limits of the bearing clearance, or in ball bearings, eccentricity; and (3) varying bias torque or changing load.

The application of auto-collimators to gear-train measurements probably can be explained best by describing laboratory experience with a 10 to 1 gear-box that is part of a 360 to 1 gear reduction. The complete transmission was built to a total composite error of less than 1 minute. Gears are a precision class, 96-pitch, 20-degree pressure angle, rotating in pre-loaded precision ball bearings.

In the upper right-hand area of Fig. 7 is a diagrammatic representation of the gear-train and auto-collimator setup for obtaining the total composite error. This is done by reading the error occurring in each 36 degrees of the slow-speed (192-tooth) shaft. Indexing for the ten readings required is by means of a pawl engaging a calibrated 48-tooth, 48-pitch gear fastened to the high-speed shaft. Curve *A* represents the readings, each obtained in the following manner: (1) Zero reflected image in collimator *N*. (2) Index high-speed shaft one complete turn. (3) Read error in auto-collimator *S* (deviation from 36 degrees).

It should be noted that at the right end of the

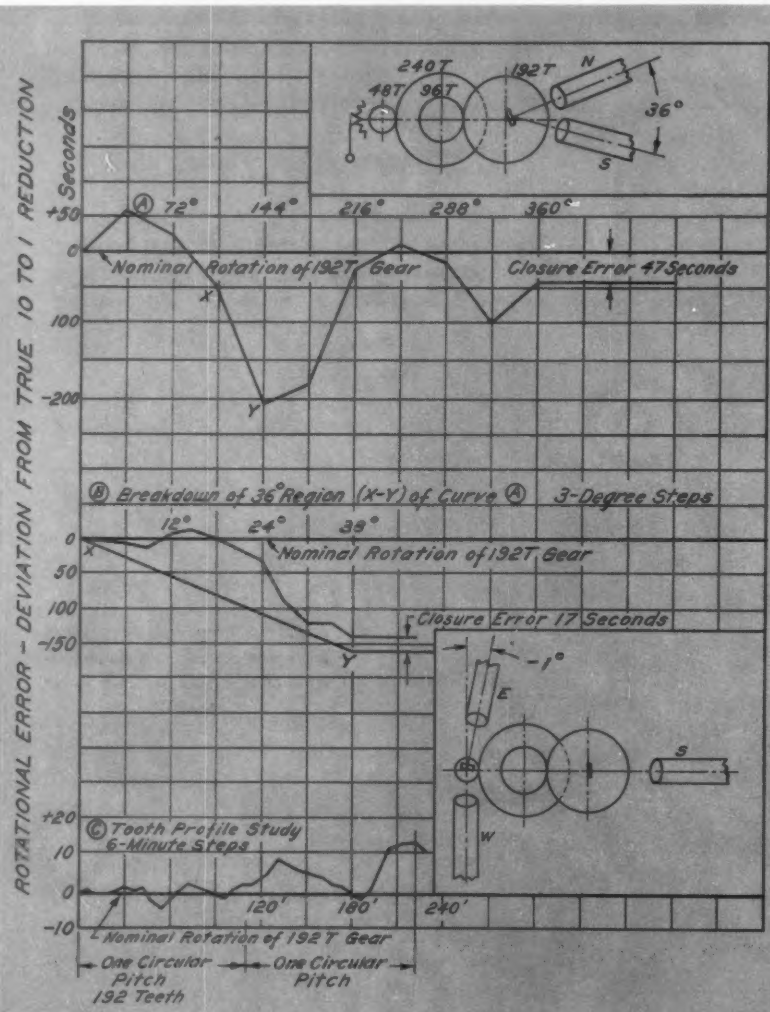

Fig. 7. The curves show the deviation from true 10 to 1 reduction in a 10 to 1 gear-box. A diagram of the gear-train and auto-collimator setup is seen in the upper right-hand corner.

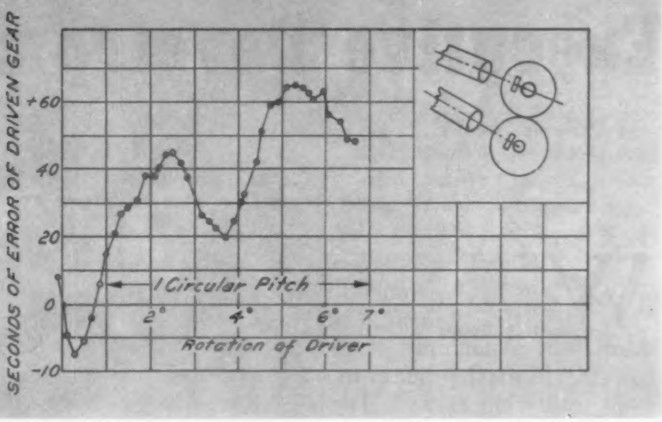

Fig. 8. This curve shows the error from true 1 to 1 ratio in a driven gear in 10-minute steps.

curve the driven gear rotated 47 seconds less than 360 degrees while the driver was indexed ten turns. The closure error was caused by a spring bias whose tension was greatest at the end of the run.

In curve *A*, the very large deficiency error of 155 seconds generated in the 36-degree section *xy* suggests that point *y* might be caused by a local tooth deformity. As a check, this section was remeasured, taking twelve steps of 3 degrees each. Curve *B* shows the results, proving that *xy* of curve *A* is satisfactory. Since this was an intermediate gear-box, four meshes removed from the final slow-speed output, a rephasing of the 96-tooth gear to the 192-tooth gear was the only correction needed.

Curve *C*, Fig. 7, illustrates tooth profile errors obtained by dividing 1 circular pitch of 112 minutes of the 192-tooth gear into 6-minute steps. In the lower diagrammatic representation are the gear train and auto-collimators. To obtain a reading, the gear-box is moved on the surface plate to zero the high-speed shaft mirror on auto-collimator *E*. Auto-collimator S is next moved to pick up the slow-speed shaft mirror. The high-speed shaft is rotated counterclockwise exactly 1 degree to auto-collimator *W*, and the displacement read in auto-collimator S. Any deviation from 6 minutes of displacement in auto-collimator S is error. In 96-pitch precision gears, the tooth profile error is usually low.

Curve *C* conceivably might reflect errors other than the tooth profile of the last mesh. A more exact method of measuring tooth profile errors is illustrated by the diagram and curve in Fig. 8. Here, there are two precision gears, each 60-tooth, 48-pitch, and supported by means of V-blocks. One carries an arm (not shown) by which it can be rotated in suitable increments. The procedure is to bring an auto-collimator to bear on the mirror above each gear, rotate the driver about 10 minutes, and read the exact displacements in the respective auto-collimators. The curve shows the results of a series of the 10-minute steps, totaling about 7 degrees, and gives a true picture of the pulse-like motion that two closely meshed 48-pitch gears can generate in a rotation of only 1 circular pitch

Executive Development Pays Off

By B. F. COGGAN
Manager, Convair (San Diego)
A Division of General Dynamics Corporation

WHEN Convair announced formation of its new Astronautics Division to build Atlas intercontinental missiles it was a manifestation not only of the company's technological leadership but of its executive development leadership as well. Twenty-six top executives were transferred from the management rolls of the Convair-San Diego Division.

All of these executives are highly qualified experts in the fields of engineering, operations, administration, planning, procurement, industrial relations, budgets, accounting, and other management branches. They form a sizable amount of high-caliber executive talent to be withdrawn from an organization in which the increasing complexity of management functions and booming business have created a hungry demand for competent leaders. But because of its foresight and planning, Convair, like a big-time football team, was ready to supply the executive personnel for the new division. It had a benchful of top-flight reserves ready to go into action without impairing the quality level of management performance in its own division.

Today, still more reserves are training hard and eagerly in a continuing program to improve the quality of management and provide additional executive depth for future needs. Some 120 executives are participating in the program, preparing to step into positions of greater responsi-

Fig. 1. Members of the Division Personnel Committee of Convair (San Diego) study a company organizational chart during a periodic review of the company's executive structure. Left to right are J. R. Dempsey, program director of Convair-Astronautics; A. W. Morgan, assistant manager—operations; Frank Roeder, executive development administrator and committee secretary; D. C. Wilkens, Jr., manager of industrial relations; R. L. Bayless, chief engineer; and B. F. Coggan, manager of Convair (San Diego) and committee chairman.

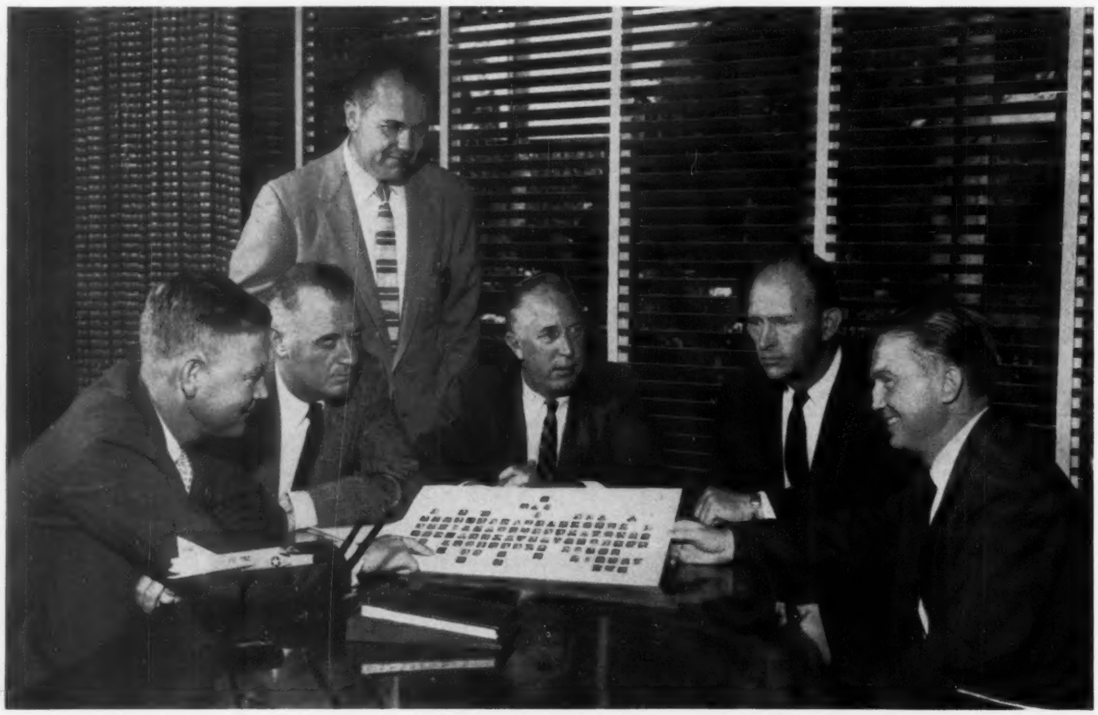

Fig. 2. Frank Roeder, left, executive development administrator for Convair (San Diego), confers with D. B. Acker, industrial engineering manager, on executive development program in which Mr. Acker is participating.

bility when the opportunity comes. Some are attending executive training classes and engineering and management courses at the University of California in Los Angeles. Others are attending seminars, work-shops, and conferences on such subjects as management, insurance, personnel, and finance. Still others are taking evening courses at San Diego State College or attending special classes in the Convair plants.

Classes range from such personal development subjects as effective speaking, clear writing, and speed reading to highly specialized subjects like production control, industrial engineering, and manufacturing and tooling administration. Many of the executives are participating in on-the-job familiarization programs. Others are learning new duties through job rotation. Some are visiting other factories to study how executives there handle their jobs.

This thriving program, operating under policies established by General Joseph T. McNarney, Convair president, J. V. Naish, executive vice-president, and R. H. Biron, vice-president—administration, is providing a strong and dynamic reserve of executives. It is interesting to note that in 1952 one of the major problems of the company was that it lacked depth in executive talent. Convair didn't have enough men trained to move into top positions in the event of company enlargement or even to replace losses by normal attrition such as deaths, retirements, or severances from the company for other reasons.

The growing size of Convair demanded more trained executive personnel. Complexity was increasing job specialization, and, in many cases, prospective leaders were not getting the over-all experience they needed. This meant that to obtain qualified men it was necessary to train them or go outside of Convair to get them. If they were needed immediately, the latter course was mandatory.

Outside recruitment is an unsatisfactory means of obtaining executive material. It is hard to find a person of the quality you need, and, once you find him, you still have to train him to your company's needs. But worse than this is the effect on morale within your own organization. Bringing in outsiders often breeds resentment, fear, and noncooperation.

It was decided to correct the situation and develop our own executives. We could not afford to leave to chance the continuity of capable high-caliber executives. As a result, in May, 1952, General McNarney announced inauguration of an executive development program for the San Diego, Fort Worth, Pomona, and Daingerfield plants of the company. Direction and execution of the over-all program was delegated to the manager of each Convair Division.

A division personnel committee was formed. It includes the division manager, the assistant manager of operations, the manager of industrial relations, the chief engineer, and the executive development administrator. The program director of Convair-Astronautics also serves on the committee until that plant is completed.

This committee was given the responsibility to review periodically the company's executive structure and the replacement strength for each executive position, and to plot the company needs for future executives. It was decided, however, that the responsibility for evaluating, planning, and executing specific plans for the development of participants rested on every line executive as a

regular and essential part of his job. It was further decided that the basic goal should be to have men three deep for every executive position in the organization. They would be men as well qualified for the position as the man currently assigned.

Tailored specifically to meet not only immediate needs but future needs as well, the program was started primarily to develop executives of superintendent rank and higher. Expansion to other levels of management is being planned.

In setting up the program at Convair-San Diego it was soon realized that a great deal of management information was necessary that had never been compiled in one package. Executive personnel needs had to be determined, and goals set up of the most important things on which to focus efforts. It was necessary to know more about key executives so that a determination could be made as to how well they were performing their jobs. An inventory of replacement supply had to be taken to uncover potential talent and investigate the capability of executives relative to target positions.

Screening of Applicants

The first step in the program, therefore, was to evaluate each participant. This often took as long as two months. But when this step was completed, an accurate appraisal of the individuals involved was available to the committee.

Each development candidate received an invitation from the division manager to an interview with the executive training administrator, who explained the program and its aims. A personal history of the participant was started at that time. When completed, it included pictures, vital statistics, educational background (including scholastic and extracurricular activities), detailed work history, training, significant outside activities (including participation in various civic and service organizations), appraisals by the man himself and his superior, development assignment reports, and periodic reappraisals. This information is essential because management needs to know what the person's interests are, where he wants to go in the organization, what his potentialities are for getting there, what training he needs, and what his progress is.

Some of the information was gained through a checklist on which the participant was appraised by himself and his superior. The rest was garnered through personal interviews with the program administrator. In many cases, the interviews produced 100 per cent more information than the original paper records of the individuals. Particular attention was given to such personal characteristics as judgment, energy, alertness, tact, courage, adaptability, perseverance, and the ability and willingness to make decisions and accept responsibility.

The final evaluation was reviewed by the department head, division executive responsible for the area, manager of industrial relations, development program administrator, and personnel committee. From these reviews the participant's superior and the program administrator prepared a training guide that outlined the necessary areas of development and specific means of obtaining such development. The superior discussed this guide with the participant and launched him on the training program. Development costs of individuals have been borne by Convair. How fast and how far the trainee goes has been a matter of personal initiative.

Re-evaluation of Executive Strength

Participants are reappraised yearly to determine needs for continued growth. At the same time, the executive strength of the organization is re-evaluated. The net result of the program has been the development of an organization of executives charted as to their readiness to take on jobs of additional responsibility. On the charts the degree of readiness is coded No. 1, 2, or 3. A man coded No. 1 for each position is considered trained and ready to take over if needed. A man coded No. 2 is not quite ready. A man coded No. 3 is taking extensive training. His readiness at this point is marginal. If an executive is needed and only a No. 3 man is available for that particular position, sometimes it is necessary to get a better qualified man from one of the company's other divisions or from outside the organization. Each individual is rated on his own merits and, therefore, it is possible to have more than one man coded No. 1, 2, or 3 for any given position.

If the company expands, or a new division is created, the replacement chart provides a quick index to ready executive material. As an example, when the new missile division, Convair-Astronautics, first was contemplated, it was decided to provide executives from within the organization to run it. With the fine group of trained executives available it was possible to assign the required talent within the time estimate for setting up the new plant and putting the division into operation. Convair-San Diego was able to provide practically all of the executive staff.

Being able to supply such a large number of key personnel to a new division and still retain a vigorous and healthy business organization is abundant proof of the value of the executive development program. No large business can remain a continuing success without such depth of executive talent.

Integrally Stiffened Panels Finished by Abrasive-Belt Grinding

Extruded aluminum-alloy structural panels for airframes are now satisfactorily finished by means of an abrasive belt. Inherent belt flexibility makes this technique readily adaptable to transversely bowed or wavy areas.

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ONE of the most significant innovations in airframe design has been the use of integrally stiffened aluminum-alloy structural panels. In these panels, the web and stiffeners are produced from a single section, either by roll forging, press forging, machining, or extruding. Greatly increased application of this design technique is forecast, because of its favorable strength-weight ratio, compactness, and reduced shear lag, as well as the simple scaling problems and low assembly costs that are involved.

Integrally stiffened panels, most common in present aircraft, are produced by extrusion. These panels, as extruded, have a skin thickness that is generally 0.10 to 0.20 inch over size. Part of the excess material is needed to satisfy producer requirements for the extruding operation. The rest of the material is needed for milling—to provide the necessary depth of cut for satisfactory finish, and to overcome possible warpage and out-of-flatness.

Experience has indicated that the amount of excess material required increases as the skin is made thicker. In the case of a required finished thickness of 0.10 inch, the addition of 0.10 inch of material suffices for machining; but for a finished thickness of 0.20 inch, an additional 0.15 inch of material is necessary.

At the Lockheed Aircraft Corporation, Burbank, Calif., many extruded panels are finished by abrasive-belt grinding. This method produces a satisfactory surface finish in a few light passes of the work beneath the belt, in contrast to the removal of a minimum of 0.06 to 0.09 inch of material required when milling. Also, it is very easy to grind off the metal evenly from transversely bowed or wavy areas.

A drawing of one of the first integrally stiffened

Fig. 1. Only 0.054 inch thick when finished, the web had to be 0.241 inch thick as extruded.

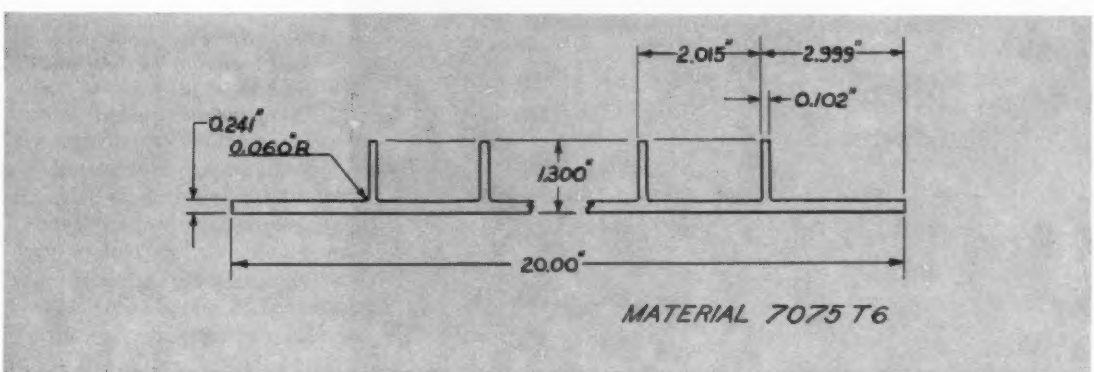


Fig. 2. The pinch rolls coming into contact with the under side of the panel are grooved to accommodate the stiffeners.

panels to be ground by abrasive belt is shown in Fig. 1. This panel had to have a finished skin thickness of 0.054 inch. Since the extrusion was designed originally to be finished by milling, the additional metal required gave the skin, as extruded, a thickness of 0.241 inch. The sheet polishing machine used was equipped with a simple grooved chuck to accommodate the stiffening members. Optimum material removal rate was approximately 3 cubic inches per horsepower-minute. The best surface finish was obtained with a depth of cut ranging from 0.001 to 0.005 inch, a belt speed of 6500 feet per minute, and a feed rate of 30 feet per minute.

Recently, the abrasive-belt grinding equipment was provided with a pinch-roll feed mechanism. This consisted of bolting a pinch-roll assembly to the bed of the machine, installing sprockets and idler brackets for a chain drive, locking the traversing bed into position, and providing baffles and an enclosure for the coolant lines. All lower pinch rolls and the billy roll were grooved to accommodate the stiffeners. This eliminated the necessity for chucking the panels, reduced floor-to-floor time, and improved the finish and dimensional tolerances.

Views of the pinch-roll feed mechanism are shown in Figs. 2 and 3. Dimensions of the panel

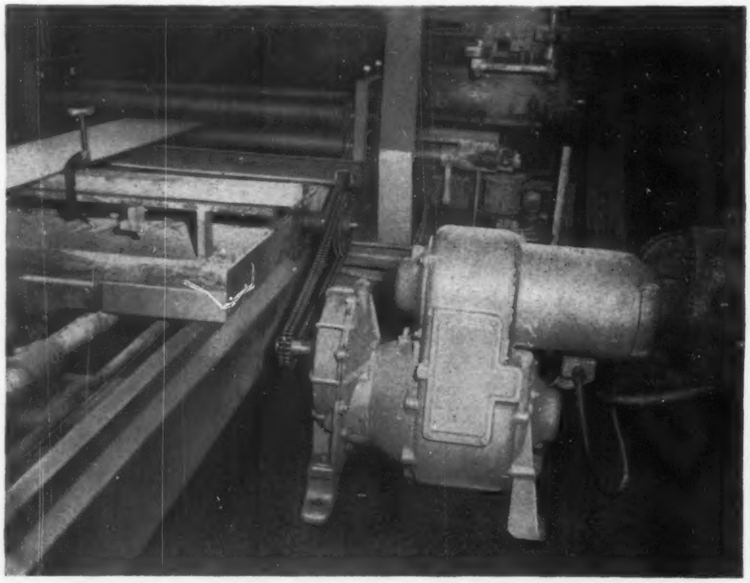
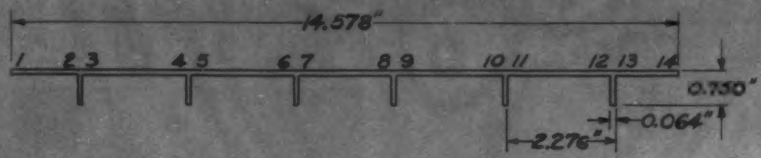


Fig. 3. The pinch-roll feed mechanism does not require the use of a grooved chuck.



Pass	Grit	Total Down Feed, Inch	Skin Thickness, Inch															Total Tolerance, Inch
			Location	1	2	3	4	5	6	7	8	9	10	11	12	13	14	
Start			Back	0.087	0.078	0.079	0.077	0.075	0.072	0.077	0.078	0.075	0.078	0.081	0.084	0.089	0.091	0.019
			Front	0.086	0.079	0.078	0.076	0.073	0.074	0.076	0.079	0.077	0.078	0.079	0.082	0.085	0.088	
1	36	0.015	Back	0.065	0.064	0.063	0.062	0.063	0.063	0.064	0.065	0.066	0.067	0.067	0.068	0.068	0.069	0.007
			Front	0.064	0.065	0.063	0.063	0.064	0.064	0.064	0.065	0.065	0.066	0.065	0.065	0.066	0.067	
2	36	0.030	Back	0.050	0.051	0.052	0.052	0.051	0.051	0.052	0.052	0.053	0.052	0.054	0.054	0.054	0.054	0.003
			Front	0.051	0.052	0.051	0.053	0.052	0.051	0.051	0.053	0.052	0.053	0.053	0.053	0.053	0.053	
3	40	0.035	Back	0.046	0.046	0.047	0.047	0.047	0.047	0.048	0.048	0.047	0.047	0.048	0.048	0.048	0.048	0.002
			Front	0.047	0.047	0.047	0.047	0.047	0.047	0.048	0.048	0.047	0.048	0.047	0.047	0.048	0.048	

Fig. 4. Tolerance of the skin is reduced from 0.019 inch, as extruded, to 0.002 inch after the final pass.

being ground are given in Fig. 4, as extruded and after each of the three grinding passes for the fourteen points indicated on the drawing.

Abrasive-belt grinding utilizing a pinch-roll feed appears to be a highly satisfactory method of surfacing integrally stiffened panels. With minor changes, rise-and-fall contouring is practical—the need for additional material for satisfactory machining is eliminated, and surface smoothness is greatly improved

Improved Heat-Treatment for Precision Investment Castings

Drilling and tapping difficulties on precision-cast, heat-resisting steel parts have been minimized at the Aircraft Engine Division of Ford Motor Co., Chicago, Ill., by changes in heat-treatment. Most problems were encountered on parts cast of AISI 410 and 431 steels.

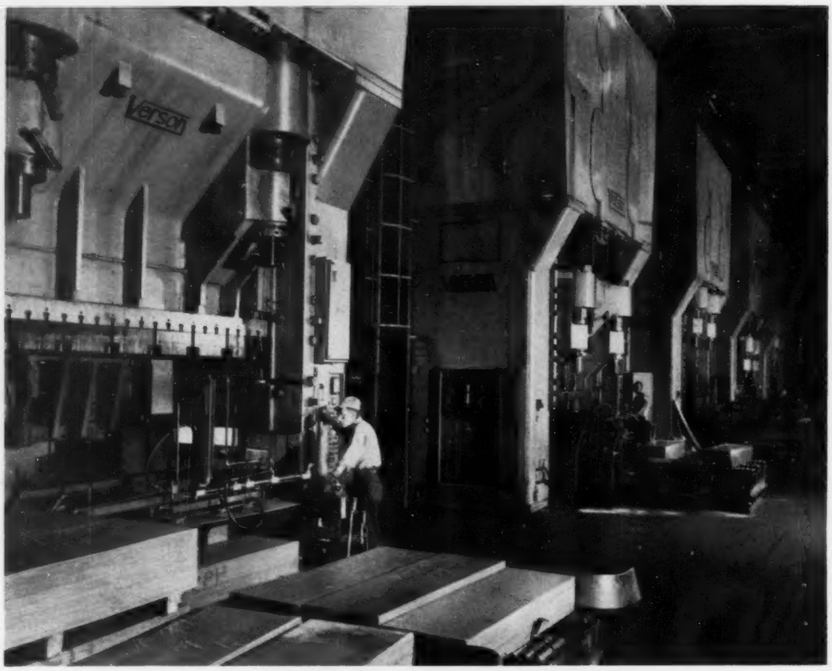
Even though the hardness of these parts was sometimes as low as 24 Rockwell C, it was impossible to turn a tap in the material. Tungsten-carbide tools worked for turning but were not satisfactory for drilling or tapping. Cobalt high-speed steel helped, but results were not consistent. Now, after changes in heat-treatment, molybdenum-cobalt high-speed tools and tungsten-cobalt tools are satisfactory.

Microscopic examination of the difficult parts revealed that the cast structures were not being broken up by heat-treatment. Long single heatings were time consuming, expensive, and obviously not satisfactory. It was discovered that several short cycles of heating and cooling broke up the cast structures much better.

On the 12 per cent chromium steel, oil quenching was found better than air cooling when hardening. With the 17 per cent chromium material, air cooling prior to hardening was best. Both types gave a better response to uniform hardening when a deep-freeze cycle was used between the hardening and tempering operations. It was also established that the alloys responded very sluggishly to the tempering operation and that each melt responded differently.

Machinability was markedly improved when the draw temperature exceeded 950 degrees F. Also, the martensite structure showed definite breakup signs. Parts are also tested for retained austenite by checking hardness before tempering and testing with a magnet. Parts which do not respond are recycled. Stubborn parts may need both a deep freeze and a 300-degree F. preliminary draw before the final draw to break up the retained austenite. This is usually the case if the carbon is low or the chromium high. When properly processed, the spotty hardness readings become uniform and parts may be tapped at a hardness of 42 Rockwell C without difficulty.

Producing Bumpers for the Chevrolet Automobile



Low-alloy high-tensile steel sheets, 0.105 and 0.120 inch thick, are spray-pickled and polished. A phosphate coating and a lubricant are then applied to protect the surfaces from scratches and to aid during drawing.

By HERBERT CHASE

MUCH has been said about the large and modern electroplating line at the spring and bumper plant of the Chevrolet Motor Division, General Motors Corporation, Livonia, Mich. However, relatively little has been published concerning the portion of this plant that feeds bumpers for the Division's line of cars and trucks to the plating machines. Polishing, phosphating, and lubrication of sheet stock before shaping is a sizable operation. So too is the drawing of bumper sections that keeps a bank of heavy-duty presses operating at near maximum capacity, most of them producing two or more parts per working stroke.

Bumpers are drawn from 0.105- and 0.120-inch thick sheets of low-alloy N-A-X high-tensile steel. The sheets are given a high polish on one side while still flat—thus saving a great deal of polishing after drawing, and minimizing the amount of wheel polishing required prior to plating.

Before flat polishing, however, the sheets undergo a spray-pickling treatment in the continuous machine shown in Fig. 1. They are fed to and removed from the machine by hand, one at a time. After being placed between stainless-steel separator bars, the sheets are advanced by chain conveyors and are sprayed while standing on edge. The first spray consists of an 8 per cent sulphuric acid solution and is followed by a water rinse. Drying is forced by blasts of hot air, following which the sheets issue from the machine and are stacked by hand.

From the pickling machine, the stacks are transported to either one of two polishing lines. Each line consists of fifteen automatic polishing machines having individual abrasive belts. Besides being driven in its normal cutting direction, each belt moves back and forth parallel to the pulley axes. Only seven rough-polishing and six finish-polishing heads are normally used, thereby leaving two spare units that can be serviced without shutting down the entire line.

All sheets are fed automatically from the stack through a roll leveler and then through the pinch rolls of the first polishing machine. Each rough polisher uses a belt having from 80 to 100 aluminum oxide grit, and each finish polisher uses a belt having from 150 to 180 silicon carbide grit. The machines have individual motor-driven pulleys and idler pulleys arranged to press the moving belt against the sheets as the work is advanced.

Polishing is done wet as an oil is automatically sprayed onto the surface of the sheets. Particles of steel that are removed from the work, as well as grit that wears from the abrasive belt, collect

below the machine and are cleaned out periodically. In each polishing line there is a gap between the machines, where parts are inspected visually. Any sheet that has defects after rough-polishing is shunted from the line by the inspector and lands on a stack that is returned to the start of the line for repolishing.

At the end of the polishing line, the sheets are checked with a surface indicator to assure a finish of 7 to 8 micro-inches. Sheets that are rejected at this inspection are repolished. Those that are accepted continue into a machine where they are washed, sprayed with a phosphate coating, dried, and given a coating of Bonderlube. The Bonderlube is largely absorbed by the phosphate coating.

This treatment affords considerable rust resistance, helps to protect the sheets against scratching, and provides a dry lubricant that improves drawing properties and tends to reduce die wear. Because of this, marring of the sheet is held to a minimum during forming and subsequent handling and, as a result, the polishing and buffing necessary prior to plating are reduced.

After phosphating, the stacks of sheet stock are transported to the line of double-acting draw presses shown in the heading illustration and placed below automatic suction-cup feed racks, Fig. 2. The sheets are picked up one at a time by the suction cups and deposited on rails, polished side up. Rocker arms slide the work along the rails and into the dies.

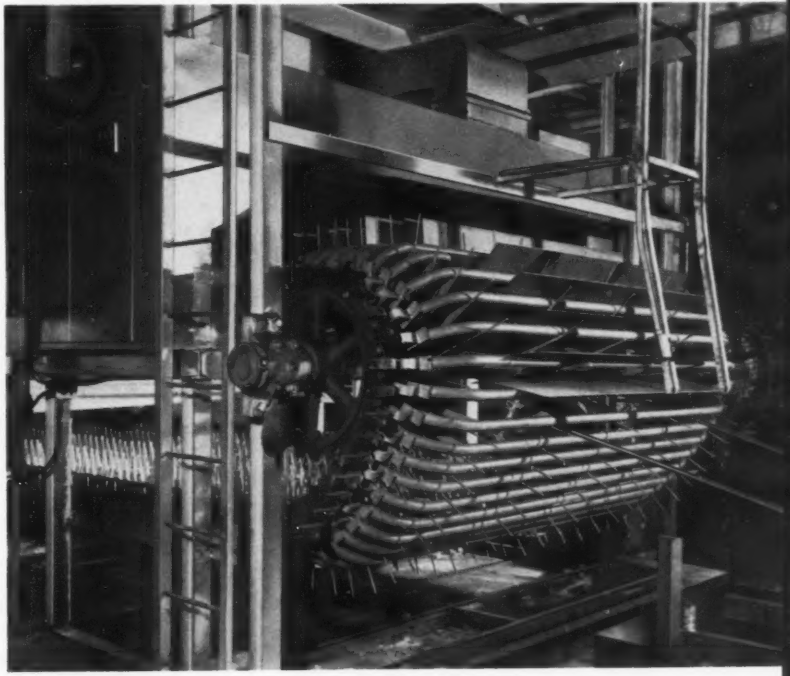
Opposite the pick-up are jets from which compressed air issues in spurts, parallel to the steel sheets. These brief blasts of high-velocity air strike the edge of the sheet and, if a second sheet should adhere to the top one, it will be separated and fall back on the stack. This eliminates the possibility of double-loading the die which closes as soon as the sheet is in position.

Nearly all bumpers are made in three separate pieces—a center section and two wing sections. Center sections are drawn two at a time, and wing sections are drawn four at a time. Front and rear bumpers are produced in different dies. A row of stampings, each containing the impressions of four wing sections, are shown at the rear of a 2500-ton press in Fig. 3. The stamping shown in mid-air has been removed from the die by an Iron Hand having two air-operated gripping fingers. These fingers have just released the part which is about to land on a pair of inclined transfer rails. Another stamping can be seen waiting to be removed from the die.

Beyond the die is a new sheet that has been placed there by the suction-cup feed rack. Because the loading and unloading units function in synchronism, only one man is needed to operate the press. Depressing one control button causes the press to close—the rest of the cycle is automatic.

Stampings that have been deposited on the inclined rails slide down to a 400-ton press into which they are loaded by hand. In the die, the wing sections are cut apart and partially trimmed. Unloading is done by an Iron Hand, and scrap,

Fig. 1. Steel sheets for bumper stampings are automatically spray-pickled with dilute sulphuric acid, washed, and then dried before stacking for delivery to the polishing line. Loading and unloading are done by hand.



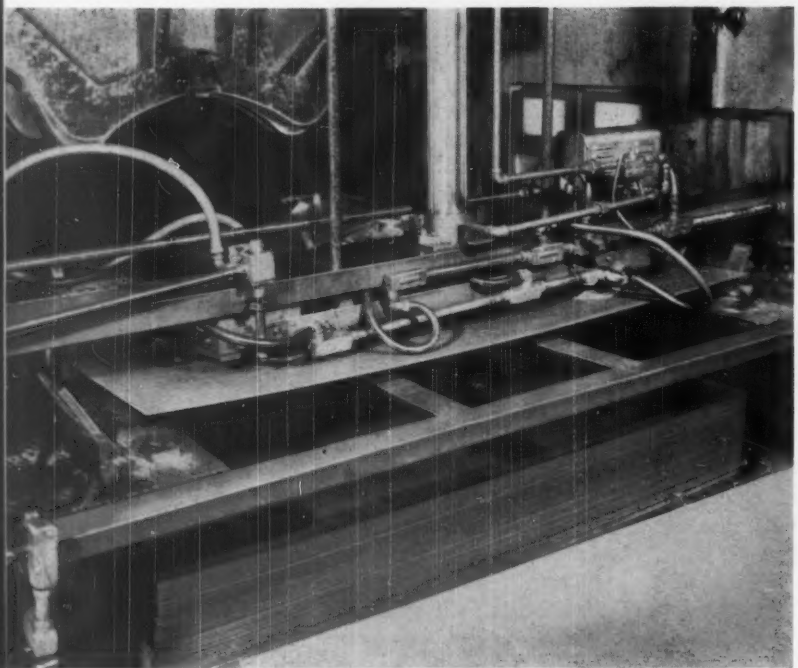
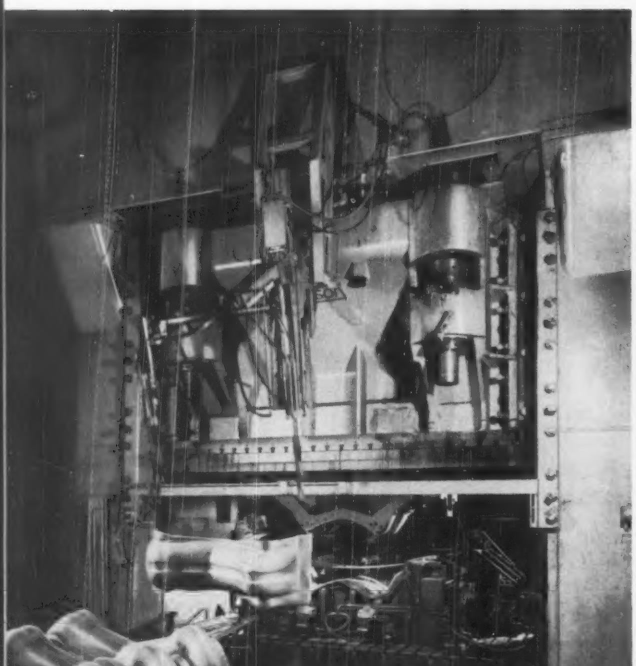


Fig. 2. Suction cups spaced along a loading rack lift one steel sheet at a time from the stack and place it on rails, polished side up, from which it is automatically advanced to the die.



cut off by the die, falls into chutes that discharge into a scrap conveyor below the floor.

The wing sections for the front bumpers shown in Fig. 4 have undergone initial trimming and are being transported by diagonally placed belt conveyors to secondary presses for piercing and additional trimming. Partial flanging is done in one press, while forming of the outer end of the stamping is accomplished in another press.

Final trimming and piercing of center-section stampings are done in a 300-ton press to which the parts are shifted by a diagonally situated belt similar to the one shown in Fig. 4. Although loading of the press is manual, the bumper sections are automatically unloaded and placed on one of three belts that carry them to a point where the edges are deburred.

Other bumper sections, including some for the company's line of trucks, are produced in similar setups that are changed as needed to meet production schedules. After the press work is completed, further edge deburring and washing—the latter to remove the lubricant added after Bond-

Fig. 3. Unloading side of one press that is drawing bumper wing sections in groups of four. The part seen suspended in air has just been automatically withdrawn from the die and released over transfer rails.

Fig. 4. Moving belts transfer bumper sections from one trim press to another. The presses are loaded manually but are unloaded automatically. Handling methods are designed to reduce marring.

erizing—are done on all stampings. Any scratches discovered at inspection are removed by touch-up belt grinding.

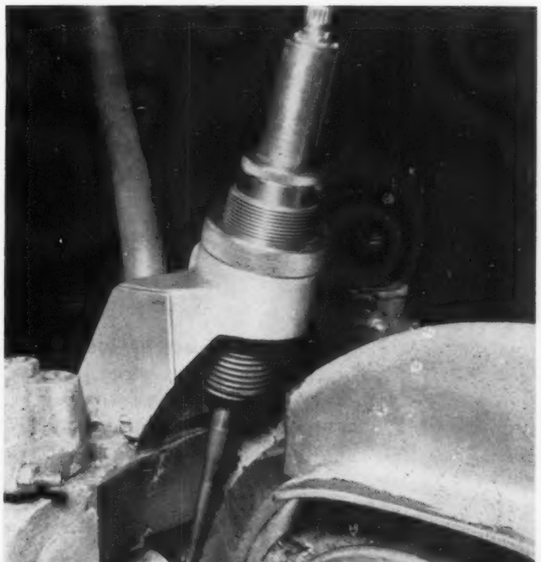
Stampings then proceed on conveyors to another polishing department. Although the polishing operation is handled for the most part by automatic machines, wing sections, partly because of their shape, are guided against the polishing wheels by hand. From this department all stampings are advanced by chain conveyors to areas where they are placed in racks for plating.

* * *

Semi-Automatic Control of Bearing Roller Grinding

A size-sensing device, designed as a control for automatic feed systems, has been employed to govern grinding operations. One such application of a unit developed by the Automatic Temperature Control Company of Philadelphia, Pa., is the semi-automatic grinding of bearing rollers.

In the operation, the rollers are hand loaded, and the infeed is manually operated until grinding is started. Then automatic feed takes over. The size-sensing device, mounted as illustrated, transmits a feed-control signal to auxiliary servo units which accurately govern the infeed to produce precisely ground rollers. The parts are manually released from the machine.



Close-up view of size-sensing device used to control automatic feed during grinding of bearing rollers.

Hole Operations Predominate in Making Fuel Control Part

FUEL controls for modern jet engines have evolved into one of the most intricate pieces of equipment in the airplane. The reason: the human pilot simply cannot cope with the fast-changing demands of engines having 10,000 pounds (and more) of thrust in normal operation, not to mention the thrust in 40,000-foot climbs and in supersonic flight. The job of the fuel control is to meter the flow of fuel to the burners in accord with power-lever positions. Compressor pressure, engine speed, exhaust temperature, and ram-inlet temperature are "read" by

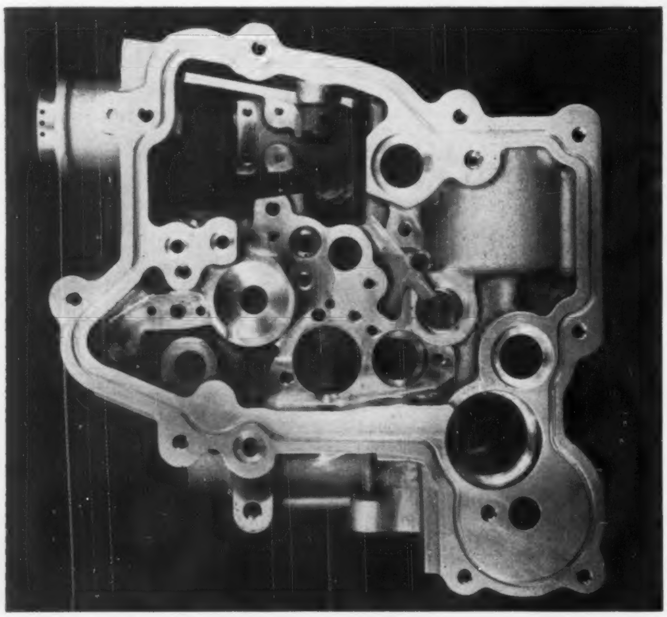


Fig. 1. This view of lower body shows the array of precision-formed holes necessary for the functioning of the fuel control.

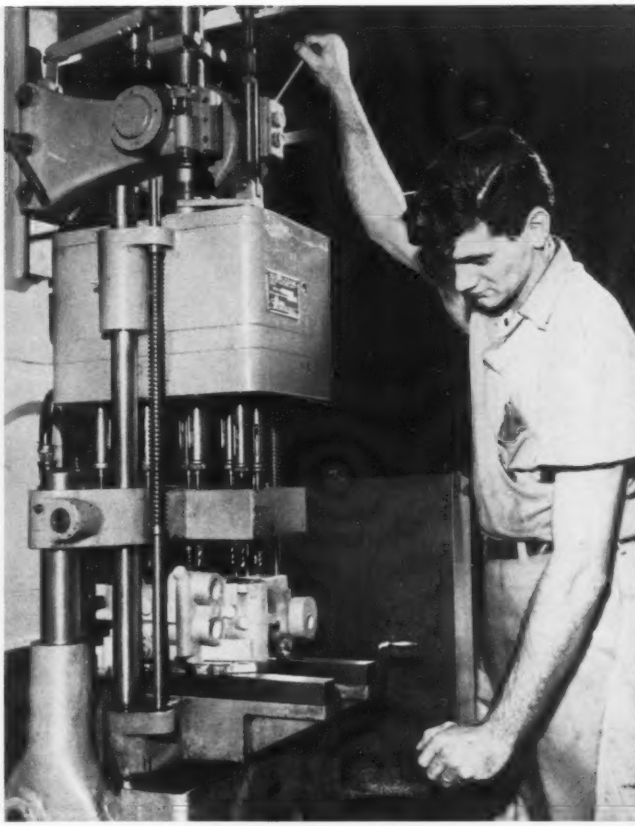


Fig. 2. The work is located on parallels by a crank-operated device.

the fuel control in order to increase or decrease fuel flow.

Hamilton Standard, Windsor Locks, Conn., the propeller-making division of United Aircraft Corporation, has been adapting itself to the jet age by designing and manufacturing, among other items, hydromechanical and electronic types of fuel controls. At latest count, these particular controls are found in fourteen different aircraft models. These range from missiles and fighters to such multiple-engine giants as Boeing's B-52 intercontinental bomber and KC-135 tanker.

To illustrate some of the interesting machining operations involved, highlights in producing the lower body of the hydromechanical fuel control are described here. The lower body, a casting of AMS 4231 aluminum, is shown in Fig. I. It is one of the three main parts of the fuel control. (Other parts are an upper body and a base.) From foundry to finished stores, some 150 distinct manufacturing operations are involved.

Castings arrive from the foundry with six pads already milled. Three are on the bottom, two on one side, and another on an adjacent side. The work is banked from these pads for machining the initial surface and two locating holes.

As can be seen from Fig. 2, hole-drilling operations predominate. In this instance, twelve small holes are simultaneously drilled and countersunk. Equipment consists of a drilling machine and a multiple-spindle drill head. All tools are subland drills, countersinking the hole as it is produced.

An interesting work-fixture is tied in with the multiple-spindle drill head and its slip-spindle plate. The body rests on a pair of machined

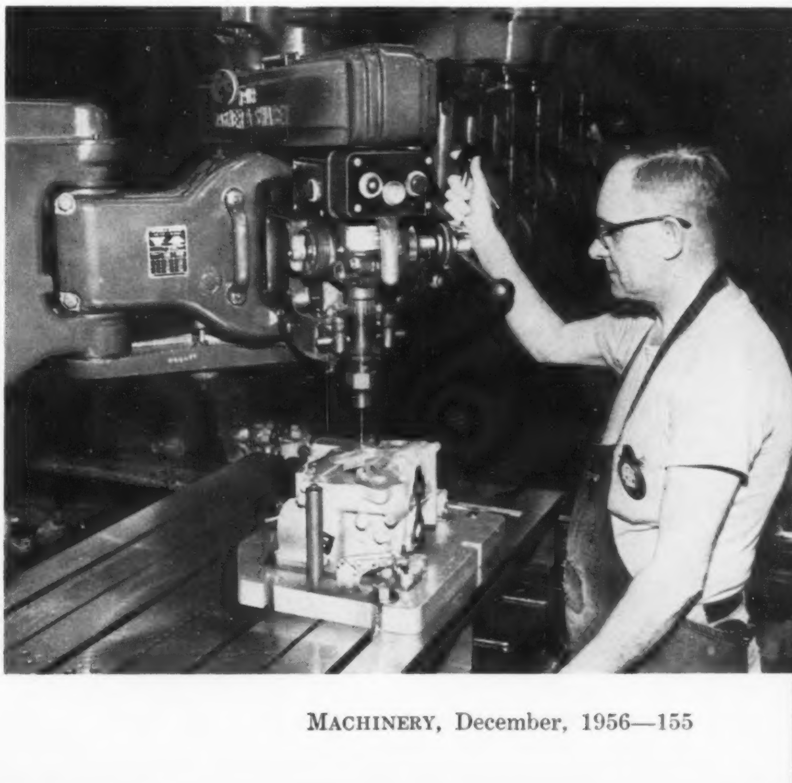


Fig. 3. The operator is here shown tapping a series of eight holes by means of which the master plate will be secured.

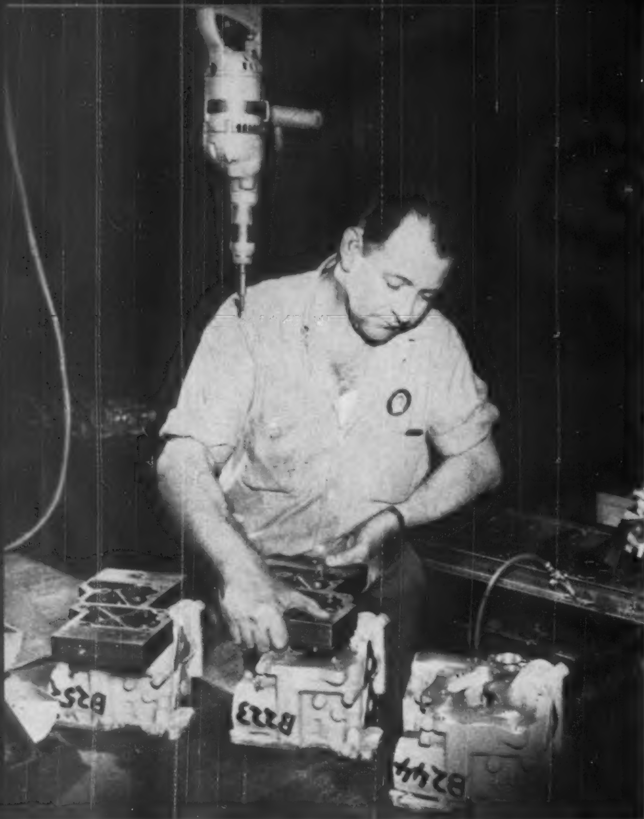


Fig. 4. The master plate serves the dual purposes of locating and protecting the work during subsequent machining.

parallels. Between the parallels is a locating-pin mechanism. By means of a crank, seen on the right of the machine, the pins are raised to enter holes previously completed in the lower surface, thus giving a positive location to the drilling pattern. Upon completing the drilling, the operator can quickly depress the pins and slide the work forward, where it can be unloaded.

After the first two dozen operations are performed on the lower body, it is secured to a steel master plate from which it is not separated until the final machining operation (Operation 104) has been performed. The purpose of the plate is to serve as a clamping base and as a drill jig for subsequent machining and thus protect the aluminum body from nicks, damage, and wear. The machine shop has 125 of these master plates—sufficient for the number of lower bodies being processed at any one time—and all are identical.

The master plate is fastened to the surface seen being drilled in Fig. 2. Eight of the holes drilled are tapped subsequently to receive capscrews securing the master plate. That operation is shown on the Warner & Swasey lead-screw tapping machine, Fig. 3. While the work is held by toggle clamps to a base, the machine spindle is floated over each hole in turn. Four of the holes are blind, and tap cartridges are first inserted in them to provide a convenient and clean manner of lubricating the tap and removing chips.

The actual assembling of the master plate to the body is performed as the bodies travel past the station illustrated in Fig. 4. Master plates from completely processed parts are continually returned to the station, where they again go into production. Running through the plate are 0.500- and 0.750-inch bushed holes. In later operations, locations are determined from pins in the machine tables and fixtures which engage these holes in the master plate.

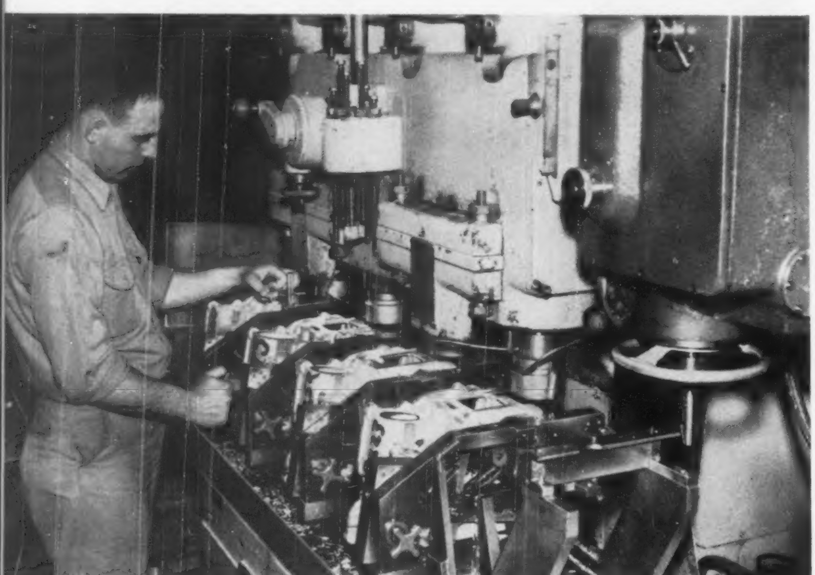


Fig. 5. Profiling the plane surface across the top of a window is the first operation performed with the work secured to the master plate.

Fig. 6. Internal contours of three pieces are completed simultaneously by end-mills under the direction of an electric tracer.

On the Cincinnati profiling machine, Fig. 5, four bodies are handled simultaneously. Each of the four spindles of the machine carries a single-blade fly cutter. The cut is a plane surface across the top of a window. Profiling equipment is necessary because of a recessed area at one point in the surface.

The hydraulic tracer, seen in the foreground, has a 1 to 1 ratio with the work. A tapered design of the tracer point permits quick adjustment for cutter wear. The master plates for each body are held vertically against angle-plate fixtures. In the illustration, the cut has been completed, and the operator is checking one of the surfaces with a flush-pin gage registering from a bushed hole in the top of the fixture.

Another profiling operation, this one on a Pratt & Whitney Keller, is shown in Fig. 6. Here, the large internal contour of the body is end-milled under the direction of an electric tracer. Three bodies are profiled simultaneously, the machine having three spindles.

Two cuts are taken, a roughing cut and a finishing cut. To preserve the close tolerance on depth (0.0005 inch), the end-mills are ground in sets of three and adjusted with an indicator to the reference step blocks seen fastened to the upper right corner of each work-fixture. End-mills are high-helix and of 1 inch diameter. Two other operations are also performed on this machine, with the same work-fixtures, but with different templates and followers.

Baker special two-station horizontal machines complete a series of operations on four holes. The heading illustration shows the roughing cuts just completed at the first station. For the finishing cuts, the work-fixture shuttles on a slide to the second station. Registration of the work at the

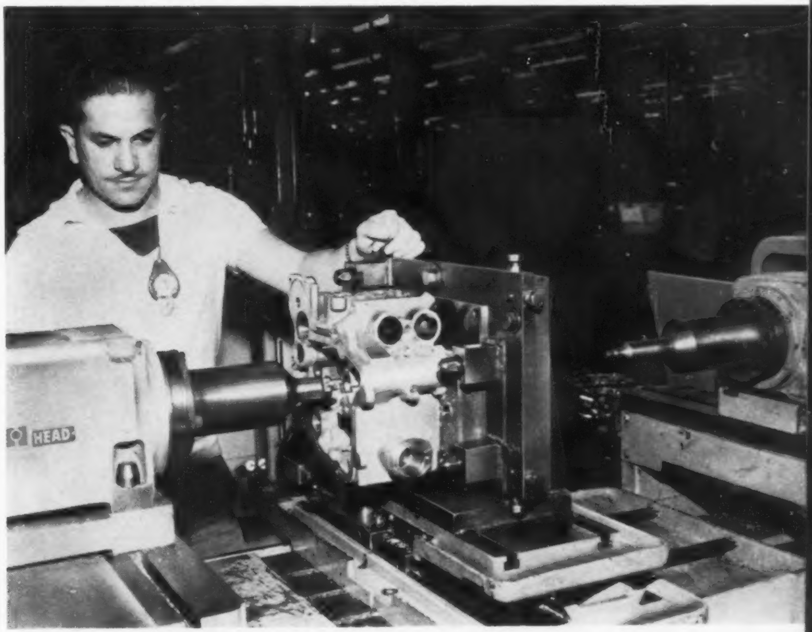


Fig. 7. To preserve alignment of holes within plus or minus 0.0005 inch, the work shuttles from one spindle to the other without repositioning.

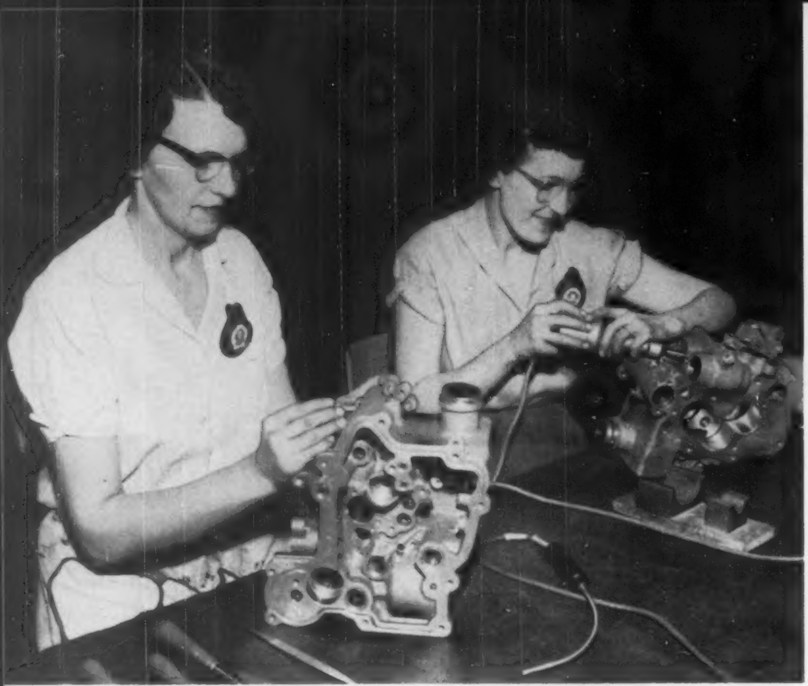


Fig. 8. Before inspection, chips and scale are removed, and sharp edges are deburred.

stations is obtained by the engagement of four pilot bars in the drilling heads with four holes integral in the work-fixture.

Roughing tools consist of one subland drill, one plain core drill, and two multiple-diameter core drills. Tools used for finishing are one plain reamer and three multiple-diameter reamers.

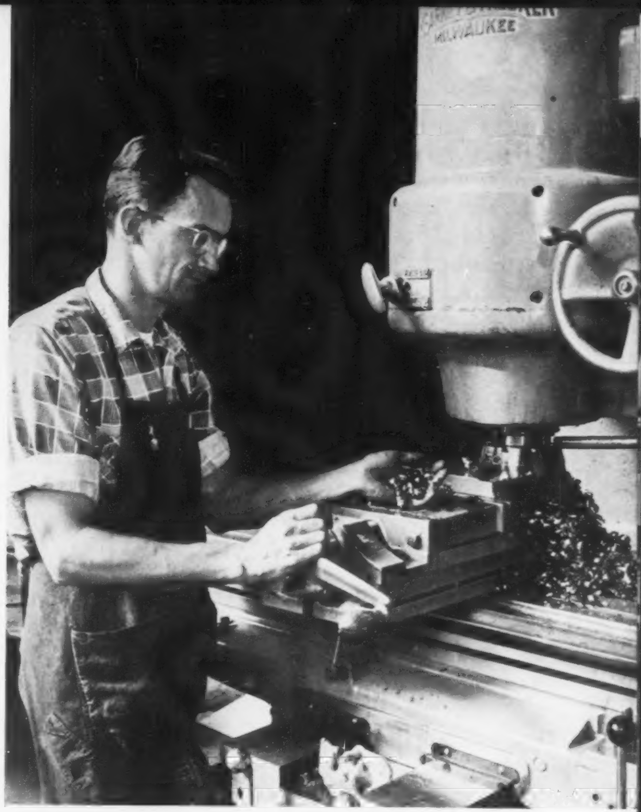
Four close-diameter holes, two on each side of the body, must have a common center line. Accuracy of location is plus or minus 0.0005 inch. The requirement is met by machining the surfaces on the double-end Heald Bore-Matic seen in Fig. 7. Both boring bars are stepped, and operate in turn as the table slide feeds to each. There is a clearance area in the angle-plate supporting the work, and a bushed hole in the master plate accommodates the pilot surface of the rear boring bar.

Bench work, Fig. 8, includes removing all loose scale on unmachined cast surfaces, and removing all sharp edges. An array of rifflers, round files, burrs, and inspection lamps are used. Procedure is well organized, and is detailed on enlarged photographs of the different work surfaces hanging in front of the benches.

Before being painted and sent to finished stores, the lower bodies undergo low-pressure and high-pressure fluid testing. The two castings in Fig. 9 are ready for the high-pressure test. High-pressure regions are filled with fluid, bled, and then pressure is applied at approximately 1300 pounds per square inch for fifteen minutes.

Fig. 9. Different regions and passages of the body receive either low- or high-pressure tests. This view shows two bodies ready for high-pressure testing.

Face-Milling Titanium Alloy with Carbide Cutters



By W. L. Carr
Assistant Foreman, Convair
A Division of General Dynamics Corporation
San Diego, Calif.

CARBIDE-TIPPED milling cutters cannot be successfully operated on AMS-4925 titanium alloy at the speeds and feeds normally used when machining conventional ferrous and non-ferrous materials. Tool life will be extremely short if high surface speeds are used, and, if combined with a light chip, serious fire hazard will be created.

Since milling is essentially an interrupted type of cutting operation, it results in extreme temperature fluctuation at the cutting edges when working titanium alloys. The use of chemical coolants or soluble oils apparently increases the tendency of the chip to weld to the carbide tip. It is then carried around until the tooth enters the material for the next cut, when it is knocked off by the impact. In the process, the carbide insert is chipped and the tool must be reground in a very short time.

Choice of rake angle is important in the design of a cutter for titanium alloy. Scraping or dragging action is undesirable, therefore negative rake

Fig. 1. Milling titanium alloy at 165 surface feet per minute with a chip load of 0.002 inch per tooth. The thin chips fly off in long ribbons, creating a fire hazard. Also, some chips have become welded to the cutter tips.

angles should be avoided. On the other hand, positive rake angles tend to weaken the cutting edge which is quite critical, due to the toughness of titanium. In addition, the chip does not curl properly but slides up in contact with the tooth, thus increasing its tendency to weld to the carbide tip. A neutral rake angle is recommended because it results in a free-curling chip and optimum cutting-edge strength.

Chip curl is also affected by variations in surface speed. Above a speed of approximately 125 surface feet per minute, the chip straightens out and welds to the tooth, causing premature tool breakdown. The result of operating a cutter at 165 surface feet per minute with a chip load of 0.002 inch per tooth can be seen in Fig. 1. It may be noted that some chips have become welded to the cutter tips. At higher surface speeds, in the vicinity of 350 surface feet per minute, and when taking light cuts such as 0.002-inch per tooth, the thin chip tends to catch fire easily. Titanium-alloy chips burn much the same as chips of magnesium and must be extinguished by the same methods.

Satisfactory results have generally been obtained by reducing surface speeds to a range of 85 to 110 surface feet per minute and increasing the chip load to approximately 0.004-inch per tooth with up to a 0.300-inch depth of cut, Fig. 2. Also, fire hazard was reduced and tool life increased to about 400 cubic inches of material removed per grind.

These results were obtained consistently, using a 6-inch diameter, 8-tooth face mill having brazed tungsten carbide tooth inserts. The teeth were ground to a 45-degree side cutting-edge angle, 12-degree peripheral clearance angle, 2-degree end cutting-edge angle, and 0-degree radial and 0-degree axial rake angles. A coolant mixture consisting of two parts sulphur-based oil and one part kerosene gave good tooth temperature control and increased tool life.

* * *

First Stainless-Steel Skyscraper

The newly completed forty-five story Socony Mobil building—the largest office building to be erected in New York City in a quarter of a century—is also the world's first skyscraper having a stainless-steel exterior. More than 7000 quickly installed stainless-steel panels sheathe 11 acres of exterior surface above the third floor. The strength of the material, coupled with its light weight, permitted a substantial reduction in usual wall thickness and a corresponding increase in valuable floor space.

Panels are stamped with a three-dimensional design that gives maximum strength and rigidity, reduces light reflection, and provides sharply oblique vertical paths down which dirt and grime can be readily washed by rain. The lower floors are faced with structural glass and stainless steel. Sheathing and windows were made by Truscon Steel Division, Republic Steel Corporation.

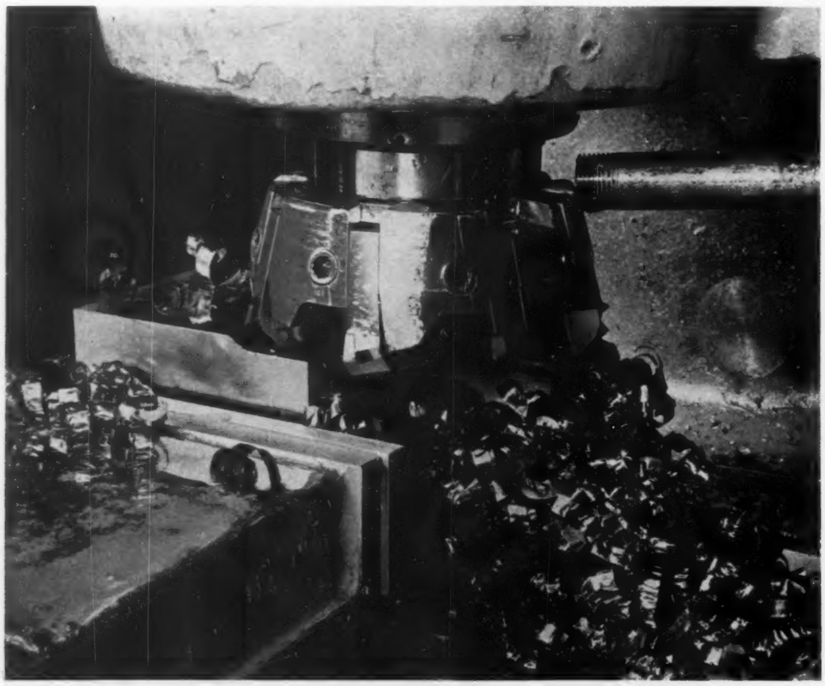
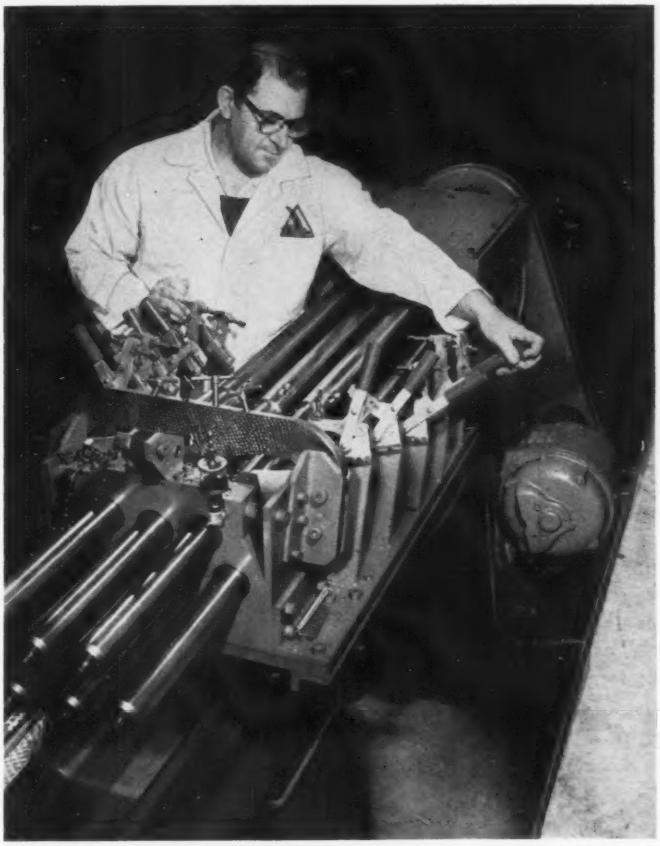


Fig. 2. At a speed of 90 surface feet per minute with a chip load of 0.004 inch per tooth, curled chips were produced that left the cutting tips clear. Longer cutter life was realized, and fire hazard was reduced.

Unique Setups Smooth Production of Airframe Components



Not only are special jigs and fixtures constructed to facilitate the machining of complex airframe components, but special machine tools are built, or existing machine tools redesigned, to keep the stream of intricate parts flowing smoothly and efficiently. Presented here is a cross-section of the numerous tooling setups being applied to meet specific production problems in one plant.

By HARRY J. HOPKINS
General Foreman
Northrop Aircraft, Inc.
Hawthorne, Calif.

MANY of the airframe components used in modern aircraft are designed to a high degree of precision. Others, though not so demanding on the tolerance side, require either numerous or awkward machining operations to bring them to their final shape. Regardless of the category best fitting any particular part, unique setups are frequently devised to speed production, reduce cost, increase accuracy, and lower rejection rates.

Several unusual setups are illustrated as applied in the shops of Northrop Aircraft, Inc., Hawthorne, Calif. Drilling and counterboring twenty-one holes in six sides of a work-piece machined from a block of 4340 steel was one case in which the elimination of frequent machine changes was considered necessary. To complete the drilling without tooling changes, a special rotary drill jig was constructed and mounted on the table of the Natco multiple-spindle drilling machine shown in Fig. 1.

The jig is of the indexing type and has six stations for drilling and counterboring simultaneously. Also, it is divided into two levels, the lower being of larger diameter to clear the upper. Twelve parts, which have been heat-treated to a tensile strength ranging from 180,000 to 200,000 pounds per square inch, can be loaded into the upper tier of the fixture—six with one end facing the drill head and six with the opposite end exposed.

Drilling operations take place at each of the six stations, during which time the jig indexes 360 degrees. The work-pieces are then repositioned on the same level of the jig and drilled from the opposite end during a similar operating cycle. While the jig is indexing, the bushing plate remains stationary, being aligned at all times with the prepositioned drill spindles.

Side drilling of the work-pieces is accomplished on the lower level of the fixture. As before, two

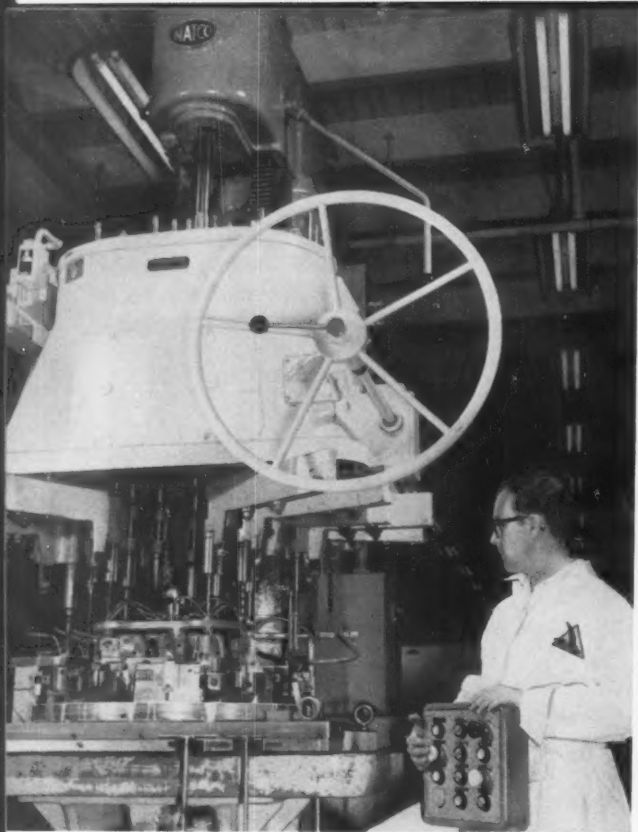


Fig. 1. A two-level rotary jig on the table of this multiple-spindle drilling machine facilitates drilling and counterboring twenty-one holes in six sides of a heat-treated steel part.

indexing revolutions are necessary to drill both sides of the parts. On the up stroke of the drill head, the operator has ample time to reposition the parts that have been partially completed and to remove those that have been finished. When the fixture is fully loaded, twenty-four parts are in process at the same time.

The company-built horizontal boring machine shown in the heading illustration was designed to accurately produce holes in a magnesium casting of concave formation. Seven long combination spindles and boring bars both rough- and finish-bore a like number of holes through the casting in a single pass. Tolerances on the hole diameters and on the center-to-center distances are 0.002 inch.

Each boring bar carries two single-point carbide cutters, one for roughing and one for finishing. Because of the concave configuration of the casting, the cutters must enter the surface with an interrupted cut. Rigid support of the long spindles is necessary. This support is provided by a pillow block that furnishes a bearing surface for the pilot ends of all seven spindles.

The casting is positioned on the fixture by locating pins. Ten toggle clamps, five on each side of the fixture, secure the work against any movement during the operation. Feed movement is provided by the carriage that supports the fixture and pillow block and is derived from the lead-screw. A semi-automatic feature of the machine is a limit switch that stops the spindles at the end of the operation. Machining time has been reduced from ten hours, using a single boring-bar technique, to forty-five minutes on the multiple-spindle machine.

Many awkwardly shaped components can be found in various locations in most airframes. Such a part, designed for use in the Scorpion F-89H, can be seen in the hands of a milling machine operator in Fig. 2. In this operation it is necessary to machine both sides of a thin web running lengthwise on one face of the part.

A pair of inserted-tooth side-milling cutters are mounted on the arbor of a Cincinnati Hydromatic

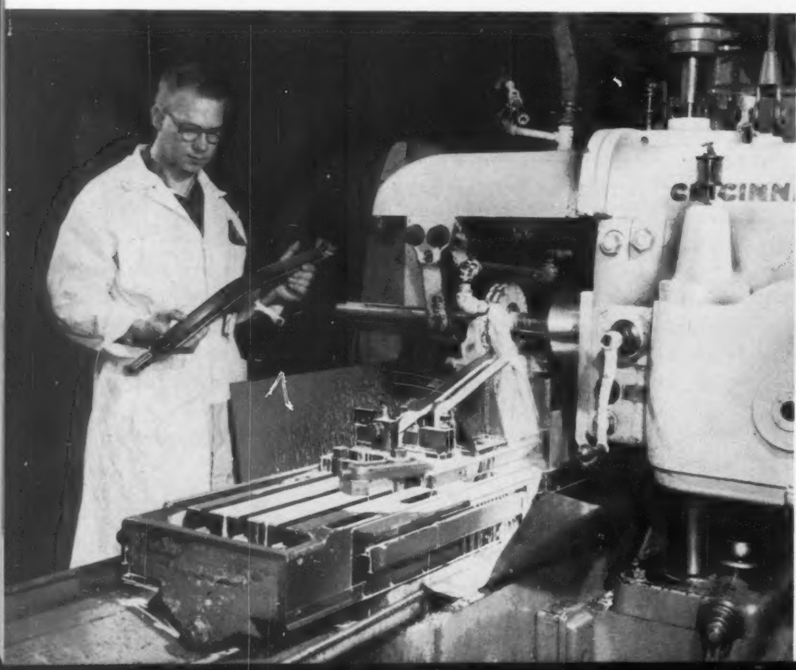


Fig. 2. Straddle-milling the center web of a dog-leg shaped air-frame member. A template is mounted on the work-table to guide cutters in following the work-piece contour.

Fig. 3. A plate-cam with integral angular clutch teeth (right) is shown with its drive-shaft (left) which has an integral set of mating teeth. Close relationship is held between the teeth and the cam lobes.

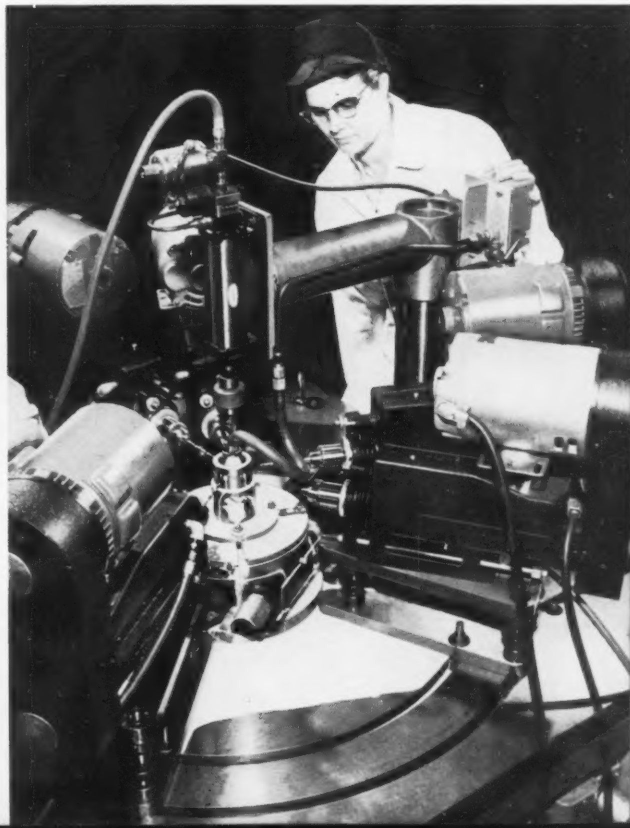
milling machine. The work-piece is clamped to an inclined fixture on the machine table. To guide the elevation of the work as it is being fed, so that the cutters will follow the correct outline, a flat sheet-metal template is secured to the inner edge of the table. A follower-roller rides along the tracing edge of the template. The roller cannot be seen in the illustration.

In Fig. 3 are shown two small parts—a plate-cam (right) having angular, positive clutch teeth on one face, and a drive-shaft (left) having mating clutch teeth on its flanged end. To cut these teeth, a No. 7 Fellows gear shaper (Fig. 4) was partially redesigned. Tooth-to-tooth relationship of the parts is consistently held to a tolerance of 3 minutes of arc. The relationship of the teeth to the cam lobes is also held to this tolerance.

Twelve holes are drilled through the wall of a

Fig. 4. This gear shaper has been partially redesigned to cut the clutch teeth on both the cam and the drive-shaft shown in Fig. 3. Tooth-to-tooth relationship is held to a tolerance of 3 minutes of arc.

Fig. 5. Flexibility is a feature of this setup in which six independent drill heads, together with an indexing fixture, are combined to drill twelve holes through the wall of a steel injector sleeve.



hollow injector sleeve on the flexible unit illustrated in Fig. 5. Six Bellows-Locke drill heads are mounted in three groups of two as shown. A 1/4-inch diameter drill is gripped by one of each pair of drill heads, and a 1/16-inch diameter drill is gripped by the other. As a result of a previous heat-treating operation, the parts, which are machined from 4340 steel, have been brought to a tensile strength ranging from 180,000 to 200,000 pounds per square inch.

The work-piece is mounted on an indexing fixture in the center of the machine table. A pneumatically operated hold-down unit is located directly over the work and, when in position, also serves as a backup bushing for the drills. Circular T-slots have been machined in the face of the table to allow the drill heads to be positioned at any desired location.

After the sleeve has been secured to the indexing table, all six spindles are pneumatically fed into the work. The smaller holes are drilled slightly lower on the part than are the larger holes. When the spindles have completed their feed stroke, they are automatically retracted. The fixture is then indexed to a second position and the spindles repeat their approach, drill, and re-

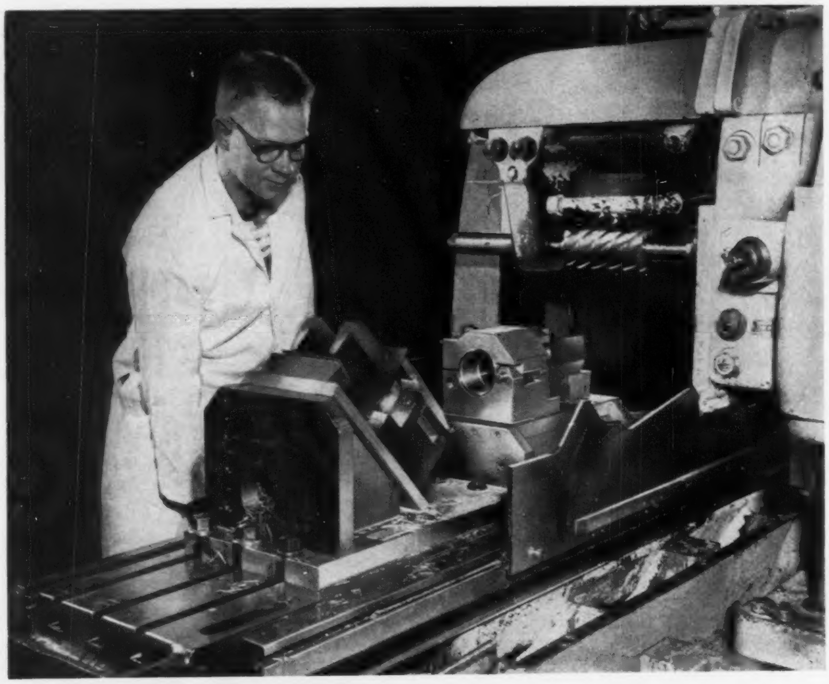


Fig. 6. (Right) Tracer-milling the outside contour of clevis type parts on a horizontal milling machine. One pass is made across the exposed edges, the parts are reversed, and a second pass completes the opposite side.

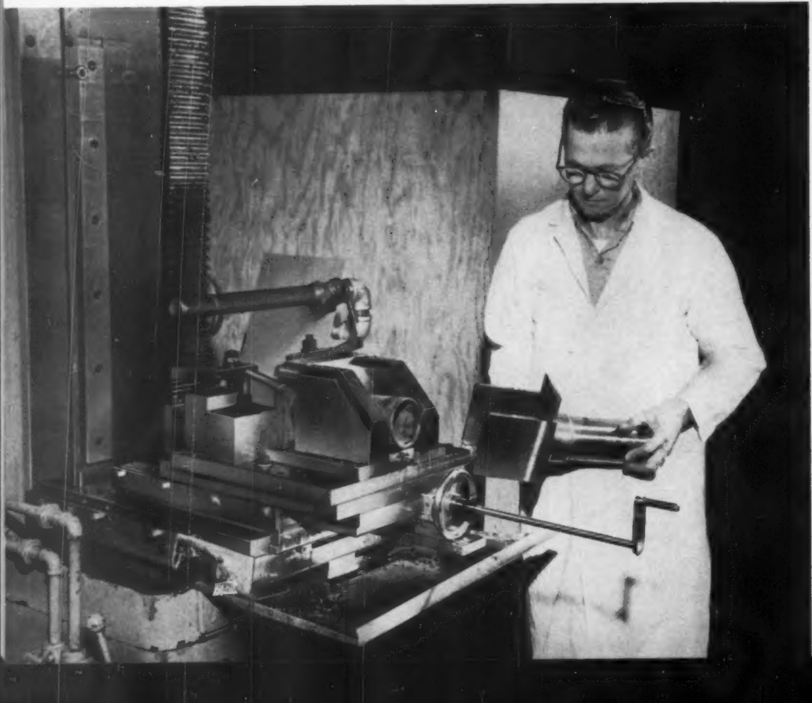


Fig. 7. (Left) All inside faces of this clevis are machined at the same time by a three-sided broach. A shuttle type fixture feeds the part into the broach as ram descends.

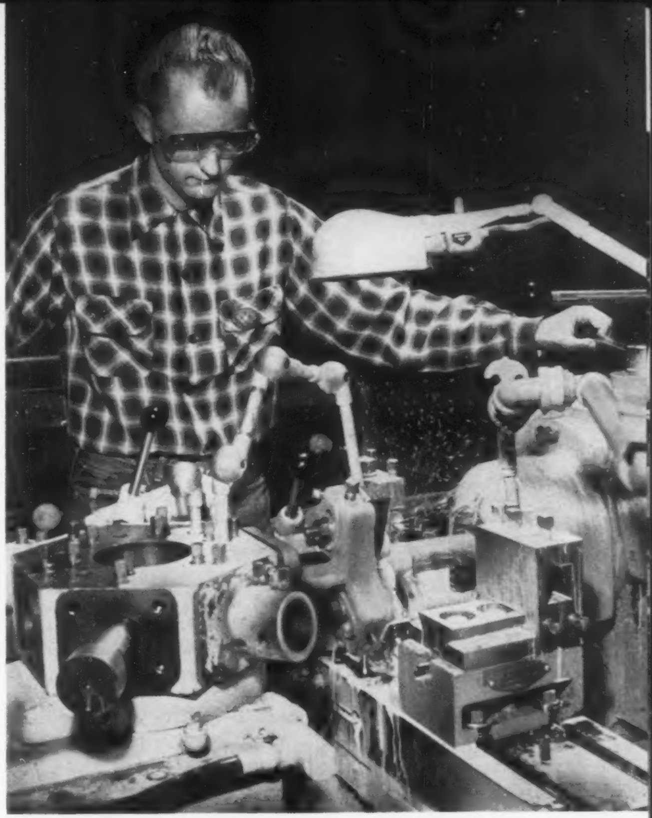


Fig. 8. A 3/4-16 steel bolt is being completely machined from 1 3/8-inch diameter bar stock in less than sixty seconds. A body-diameter tolerance of plus or minus 0.001 inch is maintained.

tract movements, thus completing the drilling operation on the injector sleeve. This arrangement of six independent drill heads and an indexing fixture has replaced three jigs that were formerly used to drill the sleeve.

A substantial amount of metal removal is necessary in the machining of clevises made from chromium-molybdenum steel. The outer contour of a pair of these parts is shown being tracer-milled in Fig. 6. Two clevises are held in a long fixture, one being supported horizontally and the other being held on an inclined plate. The machine is a Cincinnati Hydromatic and is set up with a sheet-metal template on the inner edge of the work-table in a manner similar to the arrangement shown in Fig. 2. A follower-roller rides along the upper edge of the template but cannot be seen in the illustration.

One side of each of the two parts is finished to shape by a helical plain milling cutter in one pass of the machine table. The parts are then reversed and a second pass is made to complete the opposite sides.

A three-sided broach has doubled the production of both this clevis and the type shown in Fig. 7. All three faces within the forked end of the work-piece are cut at the same time on this 15-ton, 36-inch stroke American broaching machine. The clevis is locked in a shuttle or feed-in type fixture that was made by the Pioneer Broach Co. to Northrop design and specifications. During the down stroke of the ram, the fixture advances the work into the tool until the desired depth is reached. All three inside faces are broached to a dimensional tolerance of 0.010 inch.

Less than one minute is necessary to turn, face, thread, and cut off a 3/4-16 bolt. The part can be seen being machined from 1 3/8-inch diameter steel bar stock on a new Jones & Lamson turret lathe in Fig. 8. A surface finish of 14 micro-inches is obtained, and a tolerance of plus or minus 0.001 inch is held on the body with the machine running at a speed of 1500 R.P.M.

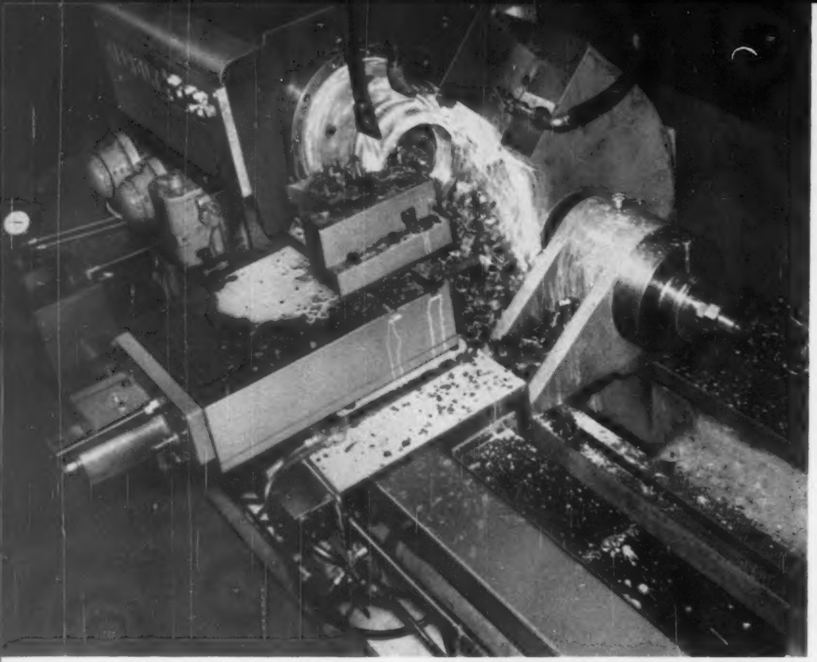
"Metal Lacing" Process for Joining Metal Sheets

The Williams "Metalace" method of joining metals has been made available to the metal-fabricating and allied industries by Metal Lace & Stitch, Inc., New York City. The process makes use of a specially designed punch and die set. Fastening occurs when the shearing action of the punch creates a parallel double incision in the metal sheets being worked. The spread of metal between these two incisions is rammed downward against the die anvil beneath the sheets being joined and between the immovable jaws of the die. The impact spreads the depressed metal sideways, creating a permanent fastening wedge. This new process, including punches and dies, is available on a licensing arrangement.

New Stainless-Steel Grades Easily Welded

Tests on the new 200 series of stainless-steel grades indicate that they are easily welded by any of the common methods. The new chromium-manganese-nickel grades help conserve the nickel supply by using about one-half the nickel content of the 300 series grades.

These investigations were made by the Research Laboratories of Allegheny Ludlum Steel Corporation on 16-gage sheet. Welded samples of the 200 series show slightly higher values of tensile strength, yield strength, elongation, and bend angle when compared with the 300 series. Higher heat or slower welding speeds were found necessary for automatic inert arc welding of the 200 series metals.



Making Large Races at

THIRTY-FOUR pounds of stock is removed in five and six-tenths minutes in machining the inner race of a double-row, spherical roller bearing from a rough forging. This is accomplished in two operations that require two and eight-tenths minutes each, floor-to-floor time.

The bearing inner race is shown in three stages in Fig. 1; (left) as a forging, (center) as rough-machined, and (right) as finish-machined. Cuts taken at speeds as fast as 350 surface feet per minute leave no chatter marks, even though the cutters for the raceways have a width of 1 7/8 inches.

Gisholt automatic production lathes are used for these operations. For the first operation, the forging is held on its outside diameter in a three-jaw air chuck, as shown in Fig. 2. Cutting tools mounted on the front slide move longitudinally to turn the periphery up to the jaws and chamfer the front end. The slide then moves transversely toward the operator to face the part and form a radius at the front of the bore.

Boring is done by a tool on the rear slide. A special attachment provides for automatic radial withdrawal of the tool from the work surface after boring is completed to prevent the tool from scoring the finished bore as it is withdrawn. The radial tool movement occurs as the machine trips into back traverse, and oil is routed through an auxiliary hydraulic cylinder mounted on the rear carriage. This unit actuates a cam that rotates the boring bar slightly to clear the tool from the work until the slide and carriage are in the loading position.

When the machine is started on a new cycle, oil returns through the cylinder, and the cam rotates the boring bar to its original cutting position. The carriage and slide then move in forward traverse until the trip into feed occurs for the boring operation.

The rear slide is mounted on a graduated swivel-base provided with elliptical holes that permit the slide to be adjusted up to 10 degrees in either direction from the normal horizontal

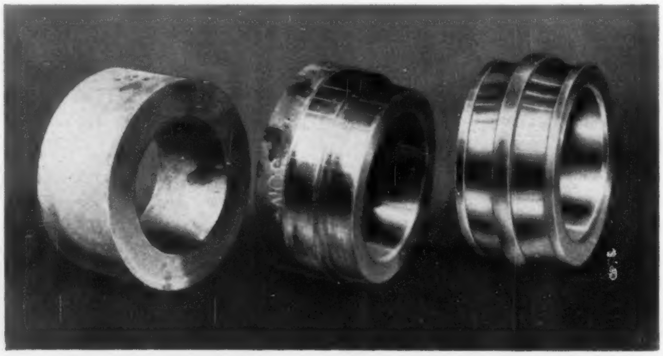
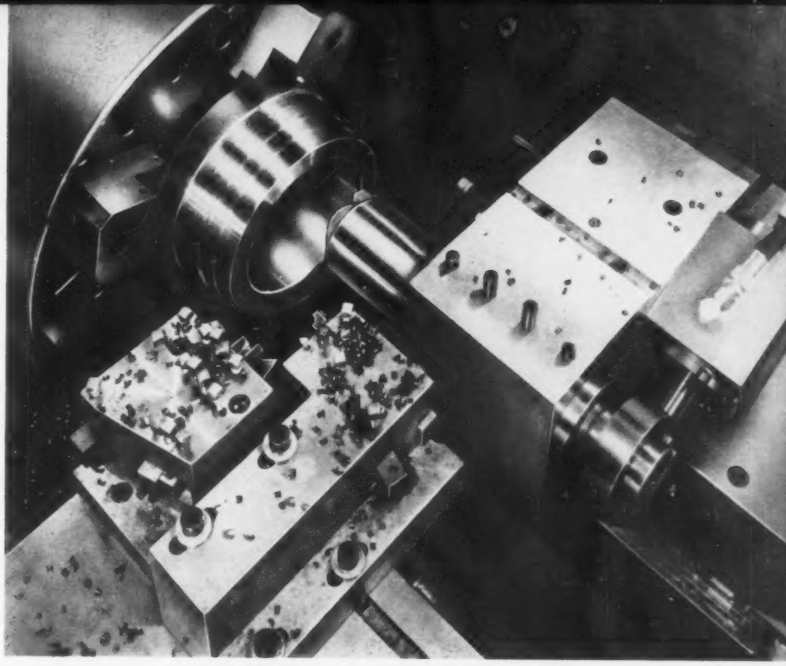


Fig. 1. Inner bearing race shown as a forging (left), after the first operation (center), and as completed by the second operation (right). The inner races of the finished part are machined on a lathe having a special rocker-arm carriage.

Roller Bearing SKF Plant



plane. The slide retains this adjustability when remounted for facing work, a feature that permits quick change-over from angular facing to taper-turning or boring.

In the second operation, the part is held on a hydraulically operated expanding arbor in the lathe shown in the heading illustration and in Fig. 3. The part is mounted with the unmachined end toward the carriage. This lathe is driven by a 75-H.P. motor. Cutting tools mounted on the front slide finish-turn the outside diameters, chamfer the projecting end of the race, and face and form the radius on the bore. A special rocker-arm type conveyor that carries cam-operated tool-blocks is provided at the back of this machine. The tool-blocks move radially to shave-form the two inner raceways, each of which is 1 7/8 inches wide. This lathe is operated at a speed of 375 R.P.M., and a feed of 0.0045 inch per revolution is employed.

The rocker assembly pivots on a shaft attached to the bed, being actuated through a hydraulic cylinder that is connected to a movable cam-plate bolted to the bed at the base of the carriage. Normally, the tools on the rocker arm are held clear of the work by a counterweight. However, when the hydraulic cylinder is actuated, the cam-plate is drawn toward the cylinder, moving the rocker arm toward the work to feed the cutters to the required depth. The length of stroke for this machining operation is set through a micrometer adjustment.

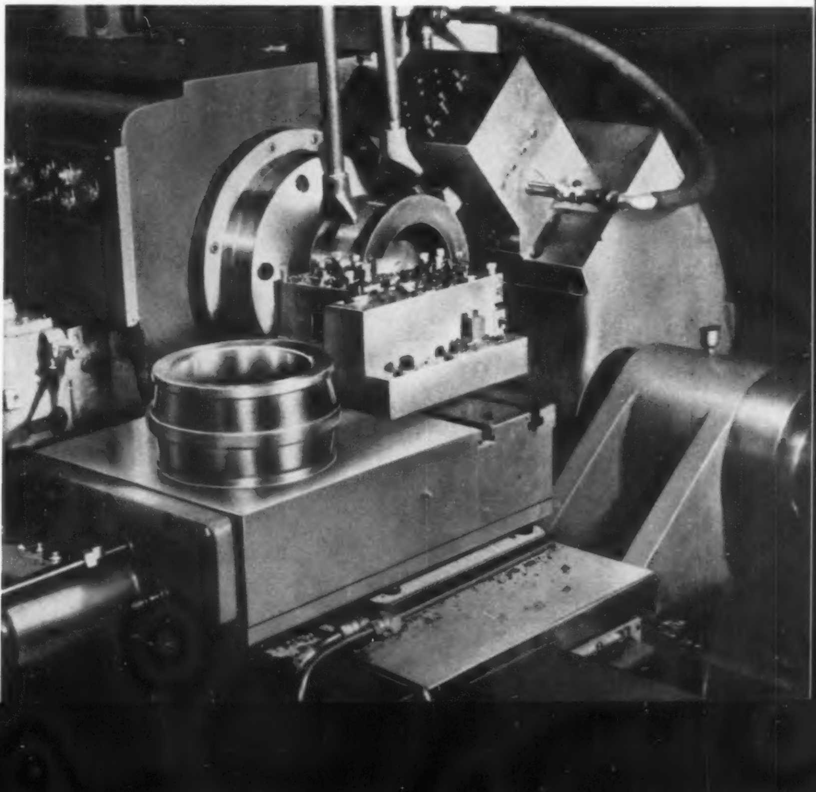


Fig. 2. (Above) First operation, in which tooling cutters turn, face, chamfer, and form a radius in the bore of the rough forging. Boring is done from the rear slide.

Fig. 3. (Right) In the second operation, the inner race is held on a hydraulically expanded arbor. Tool-blocks holding the forming tools are mounted on a rocker arm at rear of machine.

Automatic Machine Cross-Drills and Reams Small Shafts

By E. F. Guennel, Tool Designer
Clark Controller Co.
Cleveland, Ohio

THE production of bracket and rod sub-assemblies for Type CY starters and Type PM relays has been increased fivefold with a company-built automatic drilling machine at the Clark Controller Co., Cleveland, Ohio. These holes for magnet-armature pins are drilled in sub-assemblies of various sizes on the one machine.

Accuracy of both hole size and location is important since they greatly influence the life of the finished product. With the new automatic drilling machine, tolerances of location and diameter are being held to 0.0005 inch instead of the 0.002 inch formerly obtained. It has been estimated that the increased hole accuracy will more than double the service life of the magnet assembly of which the component is a part.

Drilling and reaming were formerly done in jigs on conventional drill presses at an average rate of 300 pieces per eight-hour shift. The desire to increase this output led to the consideration of an indexing table, to be used with a drill press, but then developed into a complete new machine.

Four fixtures are mounted radially on a vertical Allen dial feed table, as shown in Fig. 1. Each of the four fixtures represents an individual work position—load, drill, ream, and eject. Drilling at the second station and reaming at the third are done simultaneously, but from opposite sides of the feed table, by Hause Holomatic heads having hydraulic feed and pneumatic spindle drive. A high-speed steel, fast-spiral drill and a carbide-tipped reamer are used. The average production rate obtained with the machine is 1500 pieces per eight-hour shift.

At the first station, the operator wipes the fixture face clean and inserts the rod end of the work-piece into the fixture, as shown in Fig. 1. Location of the part is fixed by the bracket end of the rod, which bears against the outside face of the fixture, and by a hole in the bracket that fits over a locating pin.

The rod is contacted at three points by a movable V-block and by the inside surface of the flat front plate of the fixture. As the table indexes, a

Fig. 1. Inserting a rod and bracket sub-assembly into a fixture at the first station of a company-built automatic drilling and reaming machine. A hydraulic cylinder holds the work in place for drilling at the second station (top).

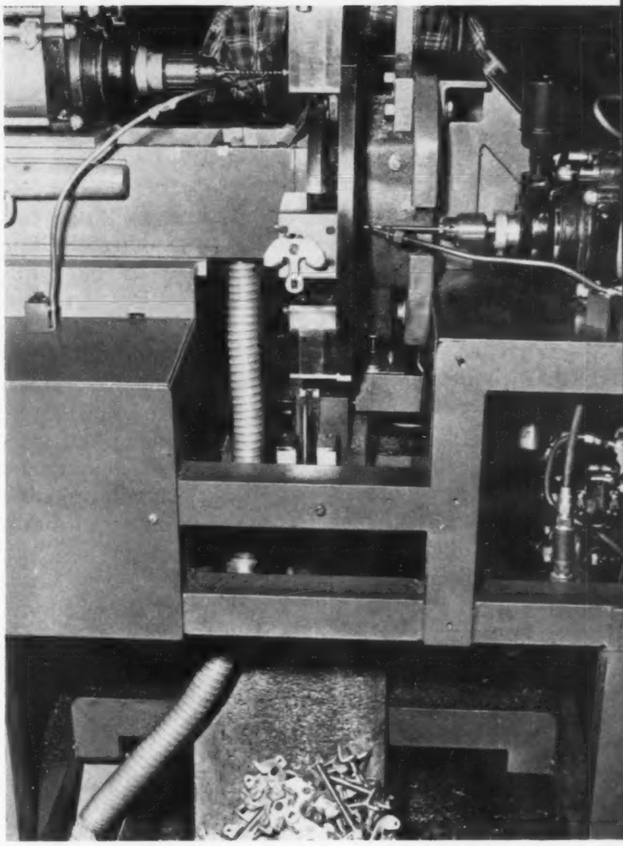


Fig. 2. Both the drill head (left) and the reaming head (right) can be seen in operation from opposite sides of the vertical feed table. At the fourth and final station (bottom of the feed table) the work is unclamped and removed by a pawl.

slide extending from the bottom or innermost face of the fixture rides along a stationary plate-cam and is pushed radially outward. The slide is wedge-shaped and, when moved by the cam, pushes the V-block toward the front plate to clamp the rod in place. To aid in holding the work-piece against the force needed to drill the hard phosphor-bronze rod at the second station, a small hydraulic cylinder clamps the bracket end of the work-piece against the face of the fixture.

As soon as the table has indexed and the hydraulic cylinder has clamped the work-piece, drilling begins at the second station, and reaming begins at the third. The cam is designed so that the fixture remains clamped at the third station. Both heads can be seen in operation in Fig. 2. When the feed table indexes between the third and fourth stations, the cam permits a compression spring within the fixture to push the slide out, thus unclamping the work. At the fourth station, a pawl attached to a hydraulic cylinder below the machine table engages the part and pulls it out of the fixture.

The ejection cylinder, the reaming head slide, and the drill-head slide retract in that order. In the meantime, the operator has loaded the empty fixture at the first position. After all retractions have been completed, a locating pawl disengages itself from a tapered slot in the edge of the table, permitting it to index to the next position. Interchangeable tables with attached fixtures facilitate handling seven different sizes of work-pieces ranging from a rod in which a 5/32-inch diameter hole is to be drilled to a rod requiring a 5/16-inch hole.

Speeds and Feeds for Metal-Slitting Saws

When using metal-slitting saws, there is a common tendency toward selection of speeds which are too high and feeds which are too low. Since metal-slitting saws are really milling cutters—even though they are thin and have a large number of finely spaced teeth—excessive speeds and light feeds can cause rapid saw wear and early failure.

According to the National Twist Drill & Tool Co., Rochester, Mich., feeds for metal-slitting saws should be lighter than those used with conventional milling cutters as there is less chip room in the finely spaced teeth. However, the feed per tooth should seldom be less than 0.001 inch. As a general starting point, a feed of 0.002 inch per tooth is suggested. When cutting deep slots with large saws, there may be so many teeth in contact with the work that even these feeds will overload the driving key and collars, resulting in saw slippage and breakage. For such operations special coarse-tooth saws (with side chip clearance if possible) should be used. In severe cases it may be necessary to use extended hubs on the saws or to drive the saws at a larger diameter with special pin-drive collars.

With any saw design, the feed per tooth must be high enough to insure that all teeth are actively cutting. Slitting saw speeds should be set after selection of the feed. The speed should be chosen to give the best compromise between tool life and production rate. Usually, saw speeds will be found to be higher than those used for conventional milling. They are often double those used for ordinary milling operations—and when slitting very thin sheet metal, even higher speeds can be used. This is because saw teeth are normally active over only a small portion of each revolution, so that there is considerable time for cooling between successive engagements with the work.

Billion Dollar Base Predicted for Machine Tool Industry

AN annual billion dollar base for shipments and new orders for the nation's machine tool industry was predicted by Louis Polk, president of the Sheffield Corporation, Dayton, Ohio, and president of the National Machine Tool Builders' Association, in an address at the fifty-fifth annual meeting of the Association held at the Edgewater Beach Hotel, Chicago, November 7 to 9, inclusive. "Machine tool shipments for the year," Mr. Polk said, "will approach 900 million dollars, and new orders will probably match or exceed 1955's net new orders of above 927 million dollars.

"This present continuing peacetime performance is evidence that, for the foreseeable future, approximately a billion dollars a year on the average—both in shipments and new orders—can be a practical continuing probability for the machine tool industry. If the nation keeps its financial house in order, that sum can be the base from which we build in the years ahead."

Discussing the growth factor of the machine tool industry by comparison to that of industry as a whole, Mr. Polk pointed out that, while the country's gross national product has climbed from 285 billion dollars in 1950 to an estimated 408 billion dollars in 1956, machine tool industry shipments have climbed from 305 million dollars in 1950 to approximately 860 million dollars in 1956. The machine tool industry has in the last five years increased its annual volume at a rate twice as rapid as the over-all growth of the total national economy. The meeting was attended by over 400 top executives of America's machine tool building companies that represent about 90 per cent of the industry's capacity.

Tell Berna, who has been general manager and executive vice-president of the Association for twenty years and who will retire from all connections with the Association on February 1, was honored at a dinner attended by the board of directors and past presidents. Mr. Berna was presented with a large sterling silver tray inscribed "by his many friends and associates in grateful appreciation and recognition of his loyal and outstanding service, 1937-1957." Around the margin of the tray were engraved facsimile signatures of present members of the board and all past presidents over the last twenty years.

In making the presentation, Mr. Polk said: "For twenty years Mr. Berna has helped to formulate the policies and guide the thinking of the nation's machine tool industry. For this we owe him a debt of gratitude. Yet above and beyond that has been the satisfaction of personal friendship with the man—for Mr. Berna truly merits



Newly elected officers of the National Machine Tool Builders' Association are: (left) Jerome A. Raterman, president; (center) Alfred V. Bodine, first vice-president; and (right) Walter K. Bailey, secretary.

Tell Berna (left) retiring general manager and executive vice-president of NMTBA, and (right) Ludlow King, who succeeds Mr. Berna in both offices.

his reputation for high ideals and breadth of vision."

Mr. Berna entered the machine tool industry with the Cutler-Hammer Co. of Cincinnati, Ohio, for which he was branch manager. After sales experience with the G. A. Gray Co. of Cincinnati, Ohio, the Union Twist Drill Co. of Athol, Mass., and the National Acme Co. of Cleveland, Ohio, Mr. Berna became general manager of the National Machine Tool Builders' Association in 1937, later becoming executive vice-president of the organization.

Jerome A. Raterman, president of the Monarch Machine Tool Co., Sidney, Ohio, was elected president of the Association. Alfred V. Bodine, president and treasurer, the Bodine Corporation, Bridgeport, Conn., was elected first vice-president, and Ralph J. Kraut, president of the Giddings & Lewis Machine Tool Co., Fond du Lac, Wis., was elected second vice-president. Perrin G. March, III, president of the Cincinnati Shaper Co., Cincinnati, Ohio, was re-elected treasurer. Walter K. Bailey, president of the Warner & Swasey Co., Cleveland, Ohio, was elected secretary.

New directors elected were Mr. Kraut, Mr. Bailey, and Edwin R. Smith, president and treasurer of the Seneca Falls Machine Co., Seneca Falls, N. Y. Ludlow King, assistant vice-president of the Association, was elected executive vice-president to succeed Mr. Berna.

One of the high points of the meeting was a panel discussion "Planning Machine Tool Production." The members of the panel represented small-, medium-, and large-sized companies of the industry. They were: Jerome A. Raterman, moderator; Norman L. Dunlap, assistant to the president, the Minster Machine Co.; Lad J. Bayer, chief industrial engineer, the Warner & Swasey Co.; Roland Nelson, production manager, Norton Co.; and Graf Dishinger, production manager, Avey Drilling Machine Co.

An extended report was made by Graham E. Marx, general chairman, Government Relations Committees, and vice-president and general manager, the G. A. Gray Co. The major accomplishment of the committee during the past year was preparing for, and actively participating in, the hearings that were conducted before the Selected Committee on Small Business of the United States Senate early last February. The record of the hearings as well as the final report provide an excellent up-to-the-minute Government authenticated picture of the machine tool industry, its problems, and its vital relationship to our Government. The Senate Committee concluded that a "healthy machine tool industry is, of itself, a defense asset of the highest order which must be considered in determining the Government machine tool policy." It observed that there was lacking a machine tool policy boldly conceived and forcefully executed. Furthermore, it stated that there appeared to have been a faltering and grudging reluctance in carrying out provisions of the Vance report.

Most certainly the Senate report will provide an excellent reference for our future activities, for it forceably endorsed the well-considered policies and objectives of our industry as they relate to our nation's mobilization planning.

Spurred by the findings of the Senate Committee and by the activities of various other branches of the Government, as well as by the activities of the NMTBA Government Relations Committee, the Defense Department has issued a Replacement of Machine Tools Directive that

is considered a step of considerable magnitude in the right direction. Briefly stated, the various service branches are required, commencing with the preparation of the fiscal year 1958 budget, to include an annual request approximating 2 to 5 per cent of the acquisition cost of the machine tools listed in the various departmental inventories. Assuming that the budget is approved, the funds provided will be utilized only for the replacement of machine tools. Furthermore, the service branches are directed to formulate and furnish to the Department of Defense their machine tool replacement program and intended procedures, so that a resultant study may be made with the objective of the ultimate establishment of a uniform Department of Defense replacement program.

Mr. Marx explained: "The 2 to 5 per cent range indicates replacement in from 20 to 50 years. This means that there is inadequate provision for obsolescence, when viewed in the light of present-day sound commercial practice. The problem is considerably further magnified when it is recognized that the percentage is applied against acquisition values rather than present-day values. Hence it will be recognized that in terms of today's higher prices replacement is indicated at something approaching two-thirds to one-half the rate of that specified in the directive. It is impossible to compete in a war with production facilities that are replaced every 35 to 50 years. Fortunately, we have recently learned (unofficially) that the percentage range has been increased to 8 per cent."

The coverage of the directive is incomplete in that it is only applicable to the replacement of machine tools that are currently in use. The tools that are in warehouse storage appear to be entirely disregarded. The intermediary class of tools in packages and stand-by lines are presumably covered by an earlier directive that was issued at the time of the Senate hearings. The directive further indicates that when funds are appropriated for the procurement of machine tools they will not be re-programmed unless such action has been specifically approved by the Assistant Secretary of Defense (Comptroller).

Summarizing, Mr. Marx said: "The Defense Department directive attests to the importance of machine tools and recognizes the need for the replacement and modernization of the machine tool reserve. But a directive, without proper policing and follow-through, conducted in an atmosphere of real urgency, will be worthless. What now remains to be seen is if positive action follows—as indeed it should and must. As matters now stand, we can expect the commencement of a Government machine tool replacement policy with uniformity and continuity. Such a policy will mean the revitalization of our defense facilities, and in so doing, should have a pronounced effect upon machine tool builders' orders."

J. Robert Jones, director, Metalworking Equipment Division, Business and Defense Services Administration, Department of Commerce, said that his division has discussed the possible reopening of the tax amortization goal with ODM and DOD and, as of the present time, is waiting for the Department of Defense to develop its most current machine tool mobilization requirements so as to have an up-to-date knowledge of the critical deficiencies. Although seventy-eight companies have indicated that they would apply for tax amortization certificates in the total amount of $83,995,000, the Division cannot provide grounds for optimistic expectation that the tax amortization goal will be reopened.

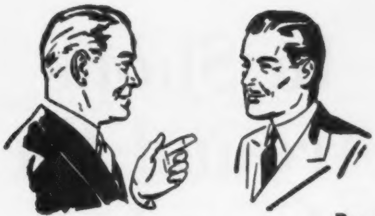
Of much greater concern is the imminent possibility that the gains which have been made relative to tax depreciation methods may be lost. The now established sum of the digits and the double declining balance methods of computing depreciation were won only by the slimmest margin of votes. Since their establishment, these methods have been the subject of constant criticism by many who are opposed to them. During subsequent sessions of Congress, bills were introduced to restrict these methods.

Mr. Berna, in his report, mentioned that the Union Stock Yard and Transit Co., Chicago, Ill., has constructed an additional building at Exposition Hall so that the exhibit area for future shows will be only slightly less than was available for the 1947 Show held in the Dodge-Chicago plant. A lease that has been negotiated gives assurance that the buildings will be available for machine tool shows in 1960, 1965, and 1970.

Mr. Berna mentioned that there has been a steady increase in the volume of orders from Canadian and overseas customers in recent years —from $53,600,000 in 1952 to an estimated $101,266,000 in 1956. At the same time, the imports of foreign machine tools have dropped from $38,135,174 in 1952 to $17,329,704 in 1956.

Addresses were also made by Delmar S. Harder, executive vice-president, Basic Manufacturing Divisions, Ford Motor Co., who spoke on the pros and cons of automatic production lines, and Merlyn S. Pitzele, senior editor "Business Week," who discussed the labor outlook over the next four years.

Tributes were again paid to Tell Berna at the annual dinner by Mr. Polk and Joel Barlow. Mr. Barlow read a humorous poem, of which he was the author, extolling the accomplishments of Mr. Berna down through the years. Entertainment was provided by the Allen-Bradley Chorus and Orchestra.



Talking With Sales Managers

By BERNARD LESTER
Management Consulting Engineer

Forecasting Sales

"I'll admit my sales forecast is a lot like the snowman I build with my kids. And the business weather will make it even more grotesque." The sales manager of a small equipment manufacturer such as the one quoted, with his wide variety of duties, is inclined to arrive at his forecast by first reviewing past sales and then gazing at the crystal ball to discover a pattern of change. However, goals are necessary to progress—particularly sales goals. Anticipated sales form the basis of planning for every department.

Essential factors in preparing a sales forecast apply both to the short-term forecast of a year and the long-term forecast covering five years or more. There are three groups of information to tabulate and use: statistics on past sales, market probabilities, and the corporate policies, facilities, and plans.

Sales Statistics. Past sales expressed in units and dollars serve as a level to work from in shaping the forecast. Segregate sales records according to territories, equipment types, and, if appropriate, industries. Identify total sales to large purchasers—or any large order—which may be a sizeable chunk of total yearly sales.

Market Probabilities. There are three aspects to a market outlook study—all constitute uncontrolled factors: (1) the probable state of general business; (2) the probable state of business in those industries of which we are a part; and (3) the probable nature and force of competition.

Foretelling general business conditions is not a science but a partially developed art. In addition to factual records, we encounter the caprice of the crowd under the influence of mass psychology.

Choose only a few outside sources who furnish statistics and advice. The Department of Commerce for one, a nonprofit research organization for another, and a private analytical forecaster for a third.

To be reliably posted on the probable state of your industry, the trade associations and trade papers head the list as sources for help. And, in your study of competitors' plans, the salesman plays a vital part as a listening post.

Corporate Policies and Plans. Preparing sales forecasts will rest upon over-all corporate plans and ability to perform. These will circumscribe or expand sales possibilities. Even though we advise top executives and directors, we must finally conform to corporate goals and provide facilities.

These are the most significant points to look for:

Plant capacity changes.

The condition of inventories.

New products to be available, or those to be dropped.

The profit rating of products which may well influence sales motivation.

Limitations in the supply of labor and materials.

Patent protection of other legal provisions that may affect sales.

But remember that fact finding, when carried too far, becomes wool gathering. A few facts and opinions, chosen for their significance and reliability, simplify decision by avoiding endless confusion.

Shaping the Forecast. The sales estimate is both evolved and resolved. It starts by asking each sales engineer: "How much business do you expect to do this coming year?" Most replies are optimistic. When fused by the sales manager, the total may appear almost prodigious. At this point a tentative sales forecast has been evolved. It is now a rough block in the hands of the sculptor.

Of course, skill, judgment, and patience are needed to resolve the final forecast. From making a close analysis of past sales operations, the sales manager proceeds to consider what the future has in store. At this point, he becomes strikingly conscious that the future is not a "store" handing out goods. What he and his associates will do may largely determine the future. And at once he finds himself face to face with problems of improved performance.

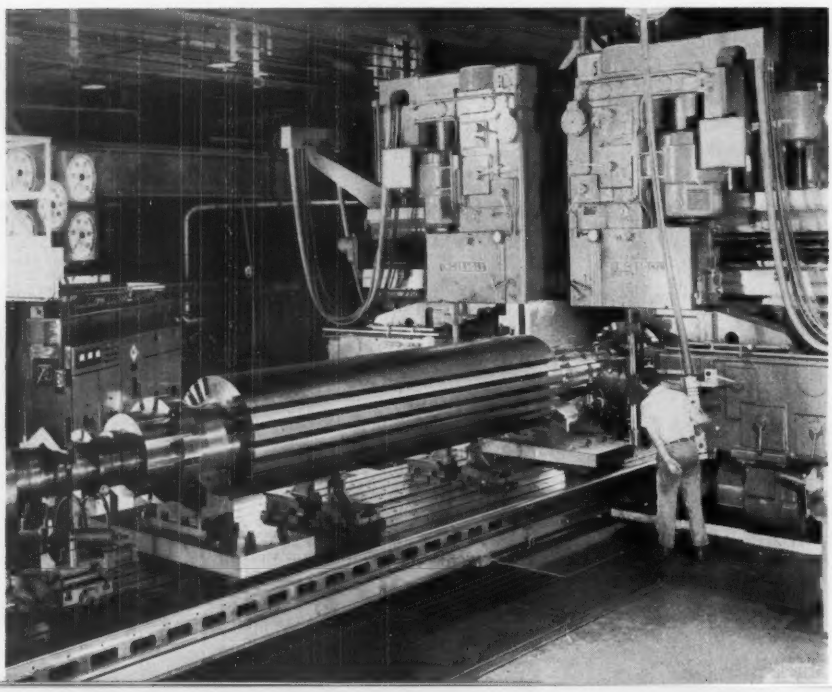
Preparing the sales forecast is a means of initiating the very highest qualities of sales management.

In Shops Around the Country

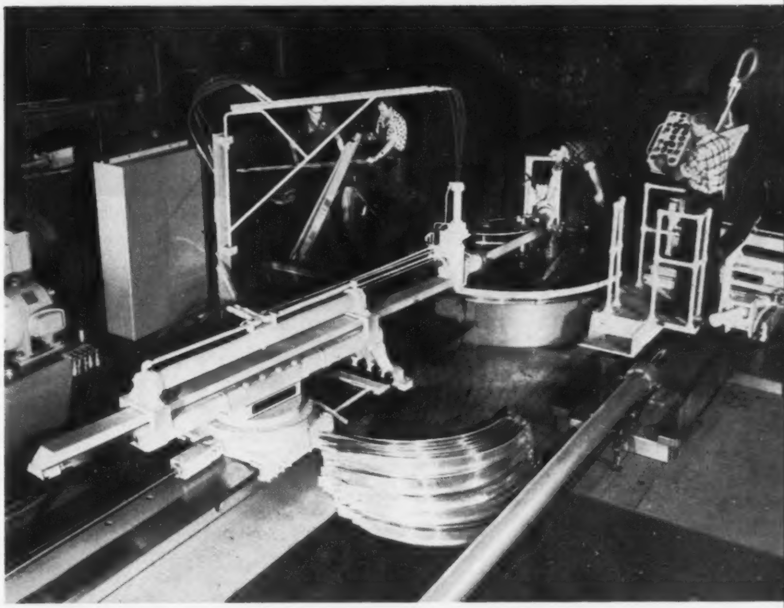
Camera highlights of some interesting operations performed in various metalworking plants

Welding threaded studs to tank drain sumps at the Brown Steel Tank Co., Minneapolis, Minn. Later, sumps are manually welded to the tanks. Since no holes need be punched and tapped, tanks are protected from a possible source of leakage. Equipment, a Nelson stud welder, is adjustable for other work.

One of the largest planer type milling machines, installed at the West Allis Works of the Allis-Chalmers Mfg. Co., Milwaukee, Wis., slots a rotor for a 300,000-K.W. steam turbine generator. Built by the Ingersoll Milling Machine Co., the equipment has four 75-H.P. heads. The table, 84 inches wide by 56 feet long, has two sections for machining one work-piece and setting up another simultaneously.

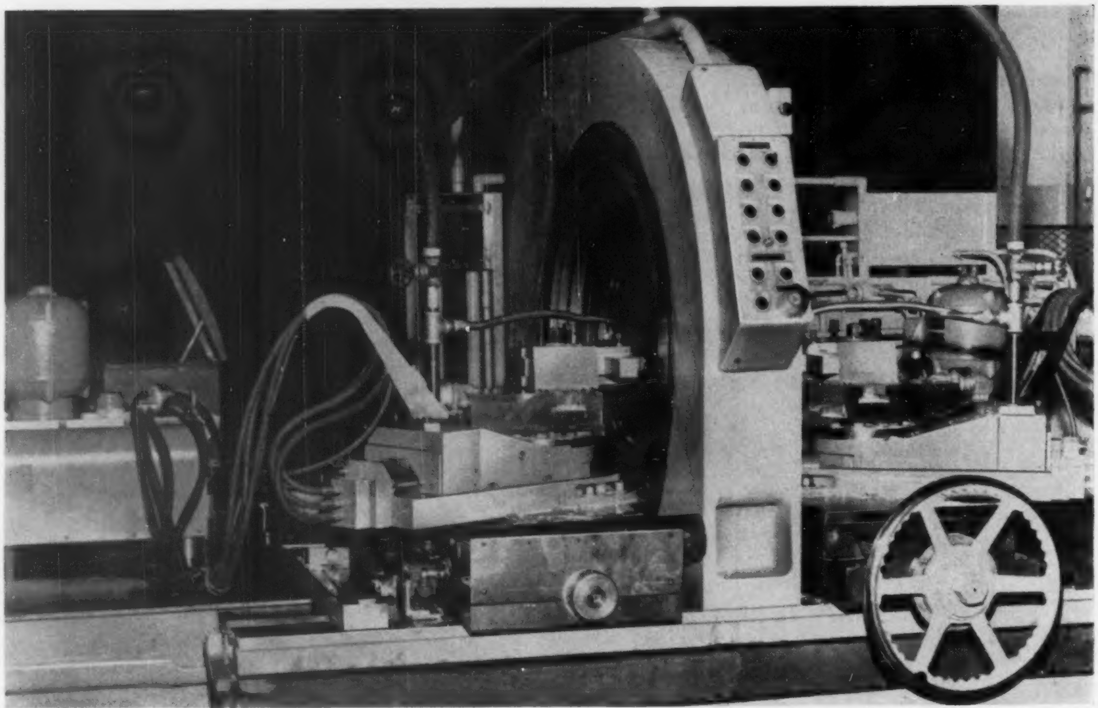


Broaching the teeth in a jet-engine compressor disc at Pratt & Whitney Aircraft, East Hartford, Conn. Teeth are produced individually, the disc being indexed for each tooth. Equipment is a Lapointe horizontal broaching machine. Nearly one-half of the discs now in production are made from titanium.



Skeletal members for helicopter fuselages are draw-formed at Sikorsky Aircraft, Bridgeport, Conn. The machine, a radial draw-former made by Cyril Bath Co., has a 12 1/2-ton stretch capacity. Some of the pieces can be seen stacked in the foreground.

At General Electric, Schenectady, N. Y., a generator rotor forging undergoes ultrasonic testing. After a light surface cut has been taken on the forging, it is rotated slowly. Vibrations sent out by the transmitter are reflected back to the receiver by any flaw which intercepts the high-frequency waves.



Photo, courtesy of Wickes Bros.

Machining Large Discs Thinner Than a Dime

By E. R. Barry and J. W. Bergman
Manufacturing Engineering
General Electric Co.
Cincinnati, Ohio

ONE of the principal problems in jet-engine design, engineering, and manufacture has been, and will continue to be, weight reduction. Remarkable progress has been made in this respect in the comparatively short time since the first jet engine was produced.

As a case in point, compressor rotor discs have tended consistently toward lighter and thinner cross-section, and they are being produced from materials developed to give adequate strength to support the new design concepts. In Fig. 1 is shown the evolution of the web of the discs. Originally, the thinnest part of the web measured 0.276 inch. Currently, it is under 1/16 inch—thinner, in fact, than a dime!

The first disc forgings for the General Electric J-35 and early J-47 engines were heavy and required much stock removal. Conventional boring mills were used, and several roughing operations had to be performed prior to finish machining. One face at a time was completed, the discs being held in heavy, solid fixtures. A cam-bar with a spring-loaded roll follower controlled the contour of the web.

Then hydraulic, tracer-controlled lathes were employed for turning jet-engine compressor discs in the General Electric plant at Cincinnati, Ohio. Most of the J-47 compressor discs made in that plant were produced on these machines. Conventional chucks were used, the discs still being rough- and finish-machined one face at a time.

When the web section was reduced from 0.187 to 0.120 inch, the work-holding problem was solved by hydraulic clamping chucks designed to eliminate vibration. One of these chucks is shown in Fig. 2. The disc was located on its

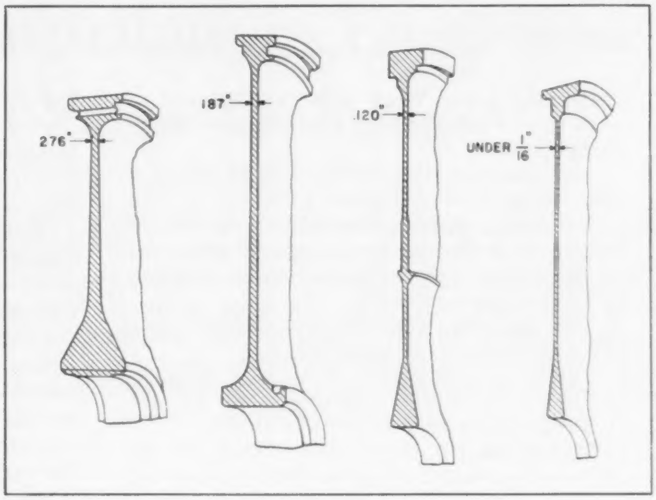


Fig. 1. The four views illustrate the evolution in web thickness of compressor rotor discs.

periphery and clamped against the chuck face. Multiple, balanced pressure plungers, similar to jack-screws but hydraulically actuated, backed up the web while the opposite face was being machined.

Difficulties far greater than previously encountered arose when the web section was further thinned. In conjunction with a chuck manufacturer, a vacuum holding device was developed, and the discs were machined successfully. Because roughing and finishing one face at a time was still required, attention had to be given to controlling the parallelism of the web and the concentricity of the rabbets on opposite faces. Then too, with the thinner sections, there was the danger of "oil canning" from unbalanced, induced, or residual stresses. Finally, machining costs were affected unfavorably because skilled operators were required.

The need for an entirely new approach was recognized, and it was decided to attempt to machine both faces simultaneously, using opposed tools synchronously controlled and holding and driving the disc by its periphery. The first step was to analyze foreseeable difficulties and draw up a set of questions that seemed to cover the problem areas of tool pressures, disc distortion, tool position control, fixturing, and machine design. (This questionnaire is shown in the accompanying table.)

Fig. 2. The hydraulic clamping chuck has multiple, balanced pressure plungers to support the web.

Items to be Considered in Machining Both Disc Faces Simultaneously

Spinning Effect—When might misalignment of tools cause a spinning effect and subsequent distortion of the disc?

Tool Alignment—How will the tools be aligned to start feeding at exactly the same point?

Tool Height—How will the height of the tools be established to eliminate any spinning effect?

Tool Setting—How will the tools be set, especially when replacing worn tools?

Tool Geometry—What will be the effect of tools not ground to the same geometry?

Tool Wear and Tool Pressure—What compensating method, if any, will be used to equalize tool pressures caused by an uneven tool wear rate?

Tool Follower Pads—Will it be necessary to use follower pads behind or in front of the tools?

Stock Removal—How will unequal tool pressures caused by variations in stock removal be compensated for?

Stress-Relieving or Stress-Inducing—How will unequal stress-relieving or unequal induced stress caused by machining be compensated for?

Surface Finish—What is the best surface finish, in micro-inches, that can be expected?

Synchronized Feed Rate—What system will assure that both tools will feed at the same rate?

Type of Tracer Control—What type of tracer control will be used?

Spindle Speed—What drive design will assure a constant surface speed?

Clamping Method—What method of clamping the disc is proposed?

Center Support—Will it be necessary to support the disc at its hub?

Spindle Bearing—What spindle construction will be used, and what type of bearings are best?

Horsepower—What size motor will be required, and will it be heavy enough for rough-machining or should that operation be performed on another machine?

Coolant and Chip Removal—How will the spindle be protected from chips and coolant?

Spindle Rotation—Will the spindle be reversible?

A Wickes center-drive lathe with a tracing attachment on each side of its spindle was located and, after some minor adaptation, used to conduct experiments. Two discs were machined. The first was machined to different contours on opposite faces, using production templates that had been fitted to the machine. The tools were aligned as closely as possible under existing conditions, and the web then machined to a thickness of less than 1/16 inch.

The second disc web was also machined to less than 1/16 inch, but without contours, being straight from the periphery to the bore. On inspection, the web was found flat within 0.001 inch in a radial distance of 8 inches. Machining the second disc flat provided a rigid test of the new technique, since it was felt that the thick hub and the rabbet diameters of the first disc provided a relatively stiff hoop support for the web section. These experiments proved the practicality of machining extremely thin discs by methods employing opposed tooling.

Fall Meeting of American Gear Manufacturers' Association

One of the features of the 1956 semi-annual meeting of the American Gear Manufacturers' Association, held at the Edgewater Beach Hotel, Chicago, Ill., October 28-31, inclusive, was the number of sessions devoted to industrial problems. There were four such sessions. There were also the customary large number of committee meetings that dealt with technical matters.

An excellent talk on industrial psychology was given at the opening meeting by William S. Sadler, Jr., Sadler & Associates, Chicago, Ill. Monday was known as "Enclosed Drives Day." The speed reducer and gear-motor committees met on that day and a paper "Basic Causes of Gear Tooth Failures" was presented by E. S. Reynolds, senior engineering representative, Socony Mobil Oil Co., Inc.

Tuesday was "General Gearing Day," and most of the coarse-pitch general gearing division committees met on that day, as well as several development division committees.

Wednesday was "Fine-Pitch and Aircraft Gearing Day." A symposium on "Ultra Fine-Pitch Gearing" was held under the chairmanship of Paul Dean, Jr., General Electric Co. A paper "Gear Size Specification and Measurement" was presented by G. W. Michalec, academic member, Columbia University.

Machine Tool Distributors Emphasize Expanded Sales Training

INDUSTRY-WIDE expansion of sales training programs to keep machine tool selling methods apace with the industry's rapid and highly diversified technological development was the theme of the thirty-second annual meeting of the American Machine Tool Distributors' Association, held October 15 and 16 at the Broadmoor Hotel, Colorado Springs, Colo. More than 400 members of the Association and their guests—including representatives of forty-seven machine tool builders—participated in group and panel discussions centering around the theme of "Better Sales Management" and over-all distribution activities in the machine tool field.

President Henry Hanson emphasized that there is no automated substitute for efficient distribution of machine tools. He pointed out that most of the essential job of putting new industrial machinery and tools to proper use can only be done by a highly skilled, well-trained distribution force. He added that the shortage of industrial production engineers must be partially offset by greater reliance on the readily available nation-wide force of distribution sales and service engineers. Mr. Hanson drew a historical picture of the change from the "old-time" machine tool distributor and the present-day sales-engineering specialist.

Government relations occupied an important role in the meeting's business sessions. R. A. Vidinghoff, president of Machinery Associates, Inc., Wynnewood, Pa., and chairman of the Association's Government Relations Committee, reported that definite progress had been made in getting Congress as well as the Renegotiation Board to recognize the unique position of the machine tool industry. He urged the Association to encourage several moves now being made toward overhauling the "obsolete" and "unrealistic" federal tax structure and to join other related and interested industrial groups in advocating complete revision of the tax structure at the earliest possible moment.

The industry's sales training program was dramatized in the form of an actual sales meeting to illustrate specific "do's" and "don'ts." Elements in effective sales meetings were cited as including (1) development of organized procedure before starting the meeting, (2) comfortable arrangements, (3) frequency keyed to circumstances, (4) convenient time of day, (5) brevity of duration, (6) pace, and (7) allowance for participation by salesmen.

Various types of distributors' programs to supplement promotion efforts by builders were discussed by the sales promotion and advertising panel. Stressing that a good advertising and promotion program is an integral part of an effective sales job, panel members enumerated the following advantages: (1) development of distributor's reputation and prestige, (2) customer education, (3) formation of product preference by customer, (4) creation of inquiries, and (5) more effective

Joseph F. Owens, Jr., (left) and Frank H. Habicht, new president and vice-president, respectively, of American Machine Tool Distributors' Association

use of salesmen's time. It was emphasized that such a program is a necessary and valuable preliminary to a salesman's contact of a potential customer but that it must be followed by effective sales representation and procedures.

New officers of the Association elected at the closing business session are: president, Joseph F. Owens, Jr., general manager of the J. F. Owens Machinery Co., Syracuse, N. Y.; first vice-president, Frank H. Habicht, vice-president and general manager of Marshall & Huschart Machinery Co., Chicago, Ill.; second vice-president, J. O. Ellison, president of Harron, Rickard & McCone Co., San Francisco, Calif.; and secretary-treasurer, J. Russell Clark, president of White Star Machinery & Supply Co., Inc., Wichita, Kan.

Fred Blackall Receives Howard Coonley Medal

Frederick S. Blackall, Jr., president of the Taft-Peirce Mfg. Co., Woonsocket, R. I., was the recipient of the Howard Coonley Medal at the thirty-eighth annual meeting of the American Standards Association held at the Hotel Roosevelt, New York City, October 22-24, inclusive. The Award was presented to Mr. Blackall by H. Thomas Hallowell, Jr., president of the Association and president of the Standard Pressed Steel Co., Jenkintown, Pa.

The citation reads as follows:

His record of leadership in the voluntary standards movement spans three decades, during which, with unceasing dedication, he has promoted, inspired, and actively advanced the cause of standards. A founder member, in 1926, of the American Gage Design Committee, he became author of the original text of this committee's fundamental report, published in 1930 by the National Bureau of Standards. As chairman of the 1946 United States mission to England, which participated in the development of the ABC Unified Thread System, he made a major contribution to the establishment of international standards. In his work on the Machine Tool Advisory Committee of the National Production Authority, he has shown himself to be a staunch advocate of standardization in federal government operations. He has spread the message of standards and their practical application in industry and the engineering professions through his activities as president of the American Society of Mechanical Engineers and of the National Machine Tool Builders' Association. He was member, and for a time chairman, of the Board of Codes and Standards of the American Society of Mechanical Engineers, and he has served on several committees of the American Standards Association. His outstanding work for standards has reached far beyond his special field of mechanical engineering and tool manufacture. He is honored today by standards men in all fields as one of their most distinguished exponents.

Previous recipients of this Award include: Howard Coonley, ex-President Herbert Hoover, William L. Batt, and Senator Ralph E. Flanders.

Fred Blackall (left) being presented with the Howard Coonley Medal by H. Thomas Hallowell, Jr.

* * *

Aluminum Engine Cylinders Have Sprayed Steel Coating

Aluminum cylinders with a thin spray coat of wear-resistant steel have been found serviceable in tests on a fully loaded internal combustion engine. Recent successes have been made possible by the patented Sprabond process of the Metallizing Engineering Co., Inc., Westbury, N. Y., which cooperated with the Aluminum Company of America on this project. The new technique solves the major problem of bonding by the use of a super-thin layer of pure molybdenum between the aluminum and steel. The thin coat of steel does not affect the expansion of the aluminum. Use of these cylinders should accelerate the development of an all-aluminum engine.

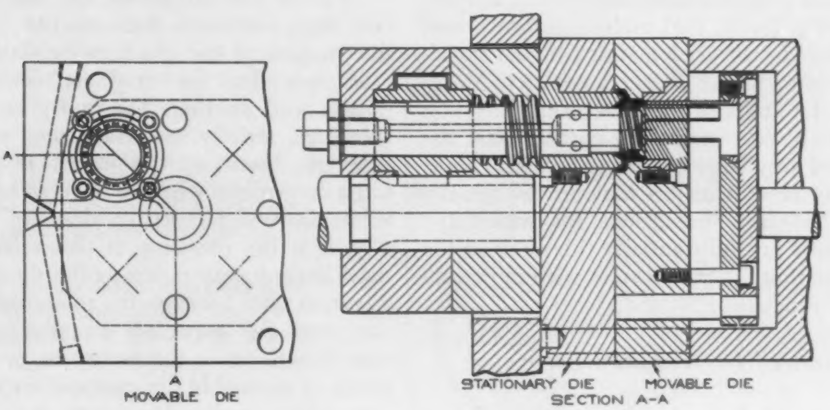
MACHINERY'S Reference Section

December 1956

HOLDING CLOSE TOLERANCES ON DIE-CAST PARTS

By

H. K. and L. C. BARTON



MACHINERY'S Reference Section

HOLDING CLOSE TOLERANCES ON DIE-CAST PARTS

By H. K. and L. C. BARTON

THE inherent precision of the die-casting process is such that dimensional tolerances on the majority of components can be maintained within the usual limits of manufacturing variation. For this reason, metrological inspection is unnecessary. The increasing use of die-castings in precision instruments such as cameras, surveying levels, fuel meters, sextants, and time recorders, however, demands a higher standard of precision in the finished product. Moreover, since the limits of manufacturing variation tend to widen with increasing casting size, the production of very large components often entails the checking of dimensions that are marginally variable. These are dimensions for which the specified limits are substantially the same as the limits of variation likely to be met with in normal commercial production.

Causes of Dimensional Errors

The sources of dimensional variation fall into five distinct groups: dimensional error in the die cavity itself; misalignment of one die member in relation to another; thermal expansion and contraction of the die cavity; variable contraction of the component subsequent to ejection; and alteration of as-cast dimensions during further processing, for example, in the course of flash removal, or as a result of a protective chemical dip.

Of these five categories, the first is concerned only with variations between the dimensions of the component and the drawing dimensions. The other four affect the variations between one component and another. Die-cavity errors are not, therefore, strictly manufacturing variations. In practice, however, the extent of these errors often determines whether the true manufacturing variations will fall within drawing limits. Actually, it is the converse of this relationship that most immediately concerns the die-caster. Given a certain ratio between the tolerance on a dimension and the expected (smaller) variation of that dimension in the course of production, the limits of allowable dimensional error on the corresponding cavity dimension are automatically established.

This relationship is illustrated in Fig. 1. The expected maximum variation of a dimension in

the course of production, which may be termed the process variation, is denoted by p, and the tolerance on the dimension, as specified on the part drawing, by t. It will be apparent that the mean value of p may vary through the range r without the extreme values of p falling beyond the limits of t, so that the limits of allowable error on the corresponding cavity dimension are $\pm r/2$. Therefore, the smaller the given tolerance t, or the larger the process variation p, the greater is the need for accuracy in the initial dimensioning of the die cavity.

Of the remaining four variables, the last does not affect the process variation in so far as the operation of the die is concerned. If, for example, a dimension of the component is reduced as a result of a surface conversion treatment (as sometimes happens with magnesium die-castings) or is increased by electro-deposition, the variations in thickness of metal lost or gained are likely to be small. Only the mean loss of accretion must be considered, and it ceases, in effect, to be a variable. Where such a constant dimensional change is foreseen, it can be allowed for initially by an appropriate adjustment of the basic cavity dimension.

For practical purposes, the process variation p can be regarded as a composite factor comprising the three other variables. These are misalignment of die elements, thermal expansion of the cavity, and cooling contraction of the die-casting itself. Misalignment, in this context, covers all variations in the position of two die elements from their nominal relationship. Linear displacement of a moving core, lateral, oblique, or angular misregistration of the two portions of a cavity, and incomplete die closure are examples of misalignment.

Since all these misalignments can occur both singly and in a variety of combinations, their effects upon dimensional variation are complex and manifold. Basically, the variables may be resolved into w, x, y, and z in Fig. 2. The variations result, respectively, from lateral play of a die element in its housing, axial displacement of such a die element, incomplete die closure, and misregistration of the main die members. Each of these variables has, in commercial practice, a characteristic nature and range. None can be completely eliminated, however meticulous the standard of die construction, since working clearances between moving parts are essential. On the other hand, observance of reasonable standards in die construction and maintenance enables them to be held within determinable limits.

The foregoing variations affect only those dimensions of a casting that are determined by faces or centers formed in relatively movable die elements. Dimensions such as v, Fig. 2, are mechanically stable. They are still subject, however —as are all the others—to thermal variation. Dimension v clearly must increase as the temperature of the die is raised, whereas the corresponding dimension of the die-casting itself must as evidently decrease during cooling to room temperature. Thus, the final dimensions of the component are largely influenced by the mean operating temperature of the tool and the temperature of the casting as it is ejected from the die. These conditions are significantly modified by changes in the rate of machine operation.

The joint effect of these two factors is shown

Fig. 1. The relation between casting tolerance (t) and cavity tolerance (r) is governed by the expected process variation (p).

Fig. 2. Here are indicated the fundamental forms of dimensional instability due to thermal variation.

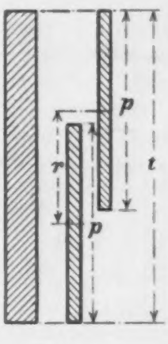


FIG. 1

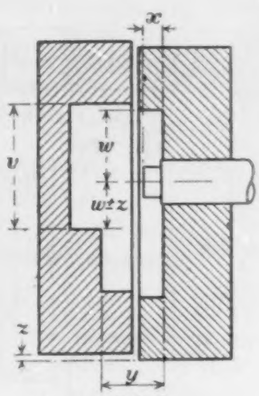


FIG. 2

Variations of Each Inch of Casting Dimensions for Different Operating Temperature Combinations

Die Temperature, Degrees F.	Temperature of Casting at Ejection, Degrees F.				
	482	527	572	617	662
	Variation, Inch				
347	0.9980	0.9987	0.9994	1.0001	1.0008
392	0.9983	0.9990	0.9997	1.0004	1.0011
437	0.9986	0.9993	1.0000	1.0007	1.0014
482	0.9989	0.9996	1.0003	1.0010	1.0017
527	0.9992	0.9999	1.0006	1.0013	1.0020

in the table, which refers exclusively to die-castings in zinc-base alloys and shows the variation per inch of a given dimension on the casting over a range of die temperatures and ejection temperatures. For convenience, these variations are related to an operating norm for which the die temperature is 225 degrees C. and the ejection temperature 300 degrees C. A combination of low temperatures shows a negative, and a combination of high temperatures a positive, variation. As may be seen, the maximum variation over these extremes of operating conditions amounts to only plus or minus 0.002 inch per inch. It must be remembered, however, that this is a cumulative variation, whereas variations due to the several forms of die misalignment are to a great extent independent of the size of the component that is produced.

On a dimension taken between two datum faces of a component that are formed within a single die element, such as *v* in Fig. 2, the only variations arising during operation are those indicated in the table. These amount at most to plus or minus 0.008 inch on a length of 4 inches and are likely, in practice, to be much less. The majority of the components produced will probably show, on test, a nominal dimension of, say, 4.00 inches, lying between 3.997 and 4.002 inches. A few will inevitably fall outside this range, particularly on the minus side, since more castings are liable to be produced from the die when it is too cold than when it is too hot.

It is thus possible to distinguish two classes of dimensional variation in die-cast parts, namely, those arising from misalignment of two or more relatively movable die elements and those due to essentially thermal factors. The latter can, for the greater part of a production run, be controlled within much closer limits than the extremes shown in the table. It is often possible to eliminate gaging on dimensions between fixed points in the same die member by rigidly discarding all castings produced before the correct die operating temperature is attained. Even when this precaution is taken, however, it is commonly desirable to check critical dimensions on any components which seem, from their surface appearance, to have been cast in a chilled die.

Checking for Errors of Alignment

Errors of alignment are not so readily controllable, especially when very close limits are to be maintained. Small displacements of the main die members are not easily detected or rectified, and it is these displacements which commonly give rise to dimensional variations that necessi-

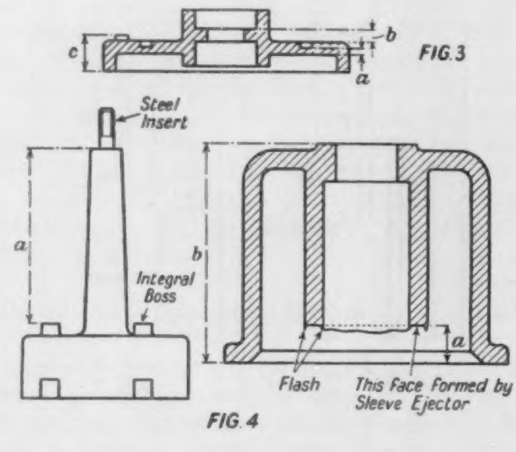


Fig. 3. The easily accessible dimension (b) may be gaged instead of the actual critical dimension (a), since their variations are virtually identical.

Fig. 4. Components in which the critical dimension (a) is not measured across the parting line.

tate 100 per cent gaging. Dimensions measured normal to the parting line often display quite large, and substantially random, variations, due to particles of metal intermittently preventing complete die closure.

When the component is formed between two rigid die members, it suffices to gage any convenient dimension across the parting line—not necessarily the critical one. Thus, with the component illustrated in Fig. 3, where the depth of the web beneath the annular groove *a* is the limited dimension, it is not necessary to gage this dimension directly. The more accessible dimension *b*, in the bore of the component, may be checked instead, since any variation of *b* will be identical with the variation of *a*. It would, in theory, be just as suitable to gage the height *c*, from the under side of the flange to the face of the small boss, but in practice this alternative is less satisfactory.

In the first place, the under side of the flange is likely, in the course of time, to show minor irregularities, due to scratches and dents on the die face. Secondly, it is usually desirable, merely for convenience of handling, to trim flash and often to belt-grind the under side of a component to remove ejector marks prior to inspection. This latter operation, of course, destroys the correlation between *c* and the other dimensions.

Dimensions such as *a* and *b* in Fig. 3 can be checked with a dial indicator. The component is placed upon a sliding gage-block and a smaller gage-block inserted in the bore. This method of checking can only be used where the variation is across the parting plane. If the dimension to be gaged, although normal to the parting, is formed wholly in one die member, it clearly cannot be correlated with any dimension taken across the parting. Examples are afforded by the long projection in Fig. 4 (left), where only excessive thermal variation of the dimension *a* is in question, and by the component shown at the right of Fig. 4, where one of the datum faces is formed by a sleeve ejector.

The length of the projection is best checked in a fixture of the type shown in Fig. 5. The dimensions of the yoke are such that the base bosses can be seated, as indicated, while the insert enters a lightly spring-loaded cup which can slide in the fixture. The nib of the dial indicator contacts the end of the cup, which has a hole of sufficient depth to allow for normal variations in the length of protrusion of the insert. The seatings for the base bosses are adjustable. Provision is thus made for any alterations in the dimension that may be called for during production, and

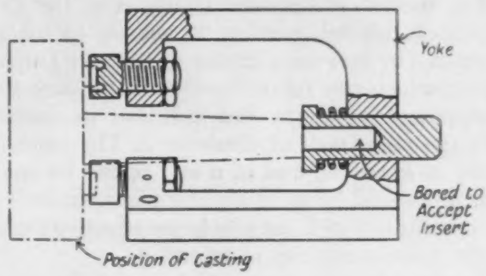


Fig. 5. A checking fixture, in the form of a three-armed yoke, for use with a dial indicator.

also for any possible correction of wear on the contact faces that may be required.

The component on which one of the faces is formed by a sleeve ejector presents a rather different problem, since at some stage it is obviously necessary to remove the flash at the sleeve end. If, on the component as cast, the dimension *a* (Fig. 4, right) is under size, the same operation can be utilized to correct it. There is, accordingly, little advantage in gaging dimension *a* on the casting prior to this operation. It is preferable to use a form cutter in a drill press or a lathe (depending upon the size and shape of the component) to clear the flash and bring *a* within the specified limits. The cutter will provide for this correction whether *a* is under or over size.

If *a* is the only critical dimension, it need not then be gaged on every casting, but only when the cutting tool is reground or replaced. If there are other critical dimensions across the parting, these can be gaged after machining in the same way as for the casting shown in Fig. 3. This procedure is desirable because the component is necessarily located for machining by reference to some datum face formed in the opposite die member. Thus, all dimensions between one of the machined faces and any point on the other face of the component are controlled by the accuracy with which the form cutter is fed.

Concentricity Checks

In die-castings that are wholly or substantially solids of revolution, it is frequently necessary to maintain concentricity within close limits. It is often, however, not essential to gage the eccentricity of the actual peripheries between which there is a critical relation. In the component illustrated in Fig. 6, concentricity may be assumed

to be critical between the recesses with radii m and n, formed in opposite members of the die. To check this relationship, it suffices to locate the part (by reference to the diameter p) upon a plug which can rotate freely, and revolve the work-piece, keeping a dial indicator in contact with the outer wall of diameter k. The concentricity of k and m, and of n and p, can be sufficiently assured by accurate die construction for the eccentricity of k and p to be an effective measure of the eccentricity of m and n.

Except when concentricity is primarily stipulated to ensure dynamic balance, it is invariably associated with the maintenance of close limits on both the diameters in question. Close tolerances on diameters m and n in Fig. 6 can be held without difficulty when each is considered separately. Should misalignment of the die members result in a degree of eccentricity sufficient to demand rectification, this clearly cannot be carried out without altering either m or n. In the example under consideration m is the obvious choice. Thus, if the required diameter of m is 1.000 plus 0.002 inch minus 0.000 inch and the as-cast diameter is 1.001 inch, the maximum eccentricity that can be corrected is 0.001 inch.

Correction and Inspection of Die-Cast Parts

If it is anticipated that, under normal conditions of operation, an eccentricity of 0.003 inch is likely to occur in some of the castings, the diameter of the core must be reduced to give an as-cast diameter not exceeding 0.999 inch. This permits rectifying the eccentricity and, at the same time, the upper limit of the bore diameter will not be exceeded. The bore will then require machining even if there is no eccentricity. Had the limits been 1.000 inch plus or minus 0.002 inch, any components which did not display any significant eccentricity could have been used without machining, providing that any draft on the core was held to a minimum. A parallel bore is usually specified when close limits are to be held, so that it is almost always desirable to reduce the diameter of the core sufficiently to accommodate any likely degree of eccentricity, and to machine all castings before they are gaged.

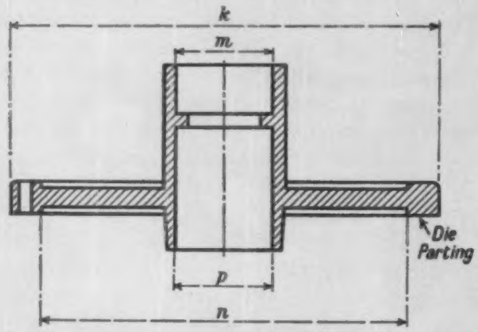


Fig. 6. Eccentricity may be checked from any two diameters formed in opposite die members by means of fixed elements.

This procedure is also recommended when cored bosses lie in the plane of the parting line, or when the parting is stepped to include a boss which does not lie in the main plane as shown in Fig. 7. In such instances, it is seldom possible to hold limits of, say, plus or minus 0.002 inch on a diameter, together with a maximum eccentricity (between inside and outside diameters) of 0.003 inch on the as-cast dimensions. Since the outside diameter is split between the die members, it is necessary to consider out-of-roundness, as well as eccentricity, and also axial displacement of the two halves of the boss. In view of the complex nature of the variations that may occur, the best course is often to machine the boss internally, externally, and on the end face.

If the dimension x, in Fig. 7, is not critical, it is often practicable to provide a single composite tool which will perform all three operations simultaneously. To check the inside and outside diameters of the part in Fig. 7 for parallelism, concentricity, and size, and also dimensions x and y, an inspection fixture must be made. This fixture will permit the casting to be held rigid and also furnish reference faces.

The inside diameter can be checked with "go" and "not-go" plug gages, and the outside diameter is easily determined by the use of ring gages. Dimension y is measured by using a planer gage; the reference point being taken from the face of the fixture. Concentricity of the part in Fig. 7 can be checked by rotating the component on a stud that is located on the fixture and also by using a dial indicator.

Gaging Fixture for an Instrument Frame

An elaborate gaging fixture for an instrument frame is shown in Fig. 8. No machining is necessary on this component apart from the tapping of a few small holes, and the only operation performed before gaging is press-trimming. Among the features checked are variations on the longer dimensions due to thermal factors. These include

the position of a hole formed by a sliding core, the relation of holes cored from one side of the component to features formed in the opposite die member, possible distortion at ejection or during cooling, and displacement of the legs due to mishandling or other causes.

The last test is carried out first, the casting being placed in the fixture with the cored holes in the ends of the legs engaging plugs S. As the diameter of each of the plugs is about 0.008 inch under size, the casting should engage easily, and if any tightness is apparent the component is removed for rectification. The positions of the cored holes in the ends of the legs are then checked with a template to ascertain where the fault lies. If the component engages easily, however, gaging proceeds.

The next step in the sequence is to insert a plug gage through the left-hand pillar of the fixture. The diameter of this gage is 0.003 inch below the nominal hole diameter, and the specified tolerance on the position of the hole, namely on dimension *c*, is thus checked. It is not necessary to gage the diameter of this hole, since the greatest possible variation lies well within the assigned limits. In order to prevent the legs from lifting away from the plugs S, the component is secured by a nut and washer (not shown in the sectional view) before inserting the gage to check dimension *c*.

A checking bar *B* is next placed in position on the two pillars, so that it bridges the casting. This bar is bored in positions corresponding to three holes cored in the upper face of the component. Dimensions *e* between these holes must be accurately maintained. Three gages are inserted in the bar and should, if the center distances are within limits, enter freely into the corresponding holes. In practice it is found that, if the end gages enter, the center gage invariably enters also, so that an equally good check would be obtained if only the two end plugs were used. As the dimensions *e* are not closely related to any reference point on the under side of the component, the checking bar *B* has appreciable play on the reduced diameters of the supporting pillars.

With the checking bar still in position, a gage-block is inserted between the projecting ribs *R* and the bar to check dimension *a* or, more strictly, the dimension *x-a*. It is actually the height of the face between the ribs from the plane of the base that is critical. The checking bar is then removed to permit checking a relation not depicted in the sectional view, Fig. 8, but illustrated separately in Fig. 9.

Four integral rivets, used to position a sub-

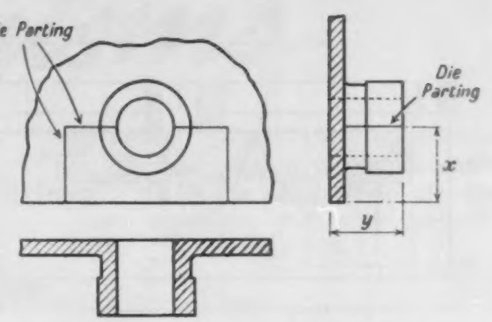


Fig. 7. Bosses formed in the split of the die, as here shown, cannot be held to close limits without a machining operation.

assembly, must be correctly positioned in relation to an annular seating on the under side of the component. To check this relationship, the lower part of the fixture is provided with a disc S. This disc can float freely on two pins and thus center itself within the recess. A rectangular template is dropped over the rivets, and a plug gage is passed through the cored opening to enter (if misalignment is not outside the permissible limit) the center hole in the floating disc.

It would have been equally possible to have fixed the disc and located the casting by the inside of the annular recess in addition to the four legs, and to have checked the rivet positions by reference to the checking bar *B* in Fig. 8. This procedure would have been complicated, however. More important, it would have linked this self-contained group of dimensions with datum points such as the centers between which the dimensions *e* are taken, on the one side of the component, and with the positions of the four cored legs, on the other side. Since the drawing dimensions were not related in this manner, the result would have been that some marginally acceptable components would have been rejected. In similar instances, such rejections have, in fact, occurred, because thermal variations do not usually affect both die members equally, and in some areas of a large casting the local result of a mechanical misalignment may be in part offset by a lesser, or a greater, expansion of the core or cavity of the die.

Importance of "Realistic" Dimensioning

It is often desirable to consider certain groups of centers or reference faces independently for gaging purposes. Usually, each group is associ-

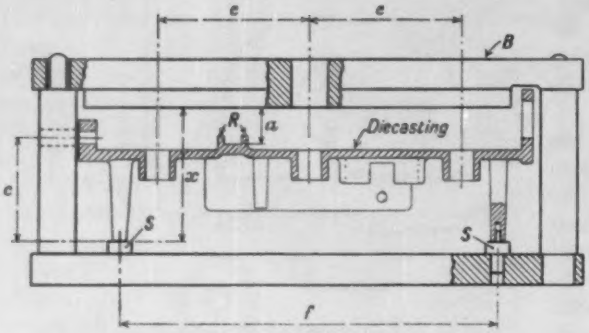


FIG. 8

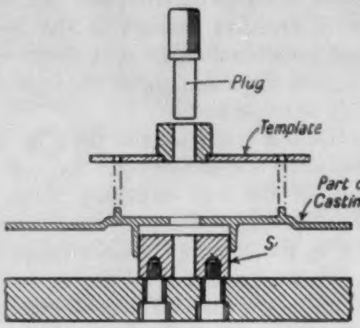


FIG. 9

Fig. 8. A multi-dimensional gaging fixture is here shown partly in section.

Fig. 9. Checking rivet positions, in relation to the circular wall beneath the component, with a template and plug gage.

ated with a separate sub-assembly, and, in the commonest case, the two faces of a component can be independently gaged. It may happen that a die-cast housing carries a number of critically related centers on one side and another group, also mutually dependent, on the other. Draftsmen frequently relate both groups to common center lines, although an analysis of the functions of the part may show this is unnecessary. It is much easier to hold close tolerances within each group, considered separately, since alignment of the die members does not affect them, than to maintain a prescribed relation between reference points formed in opposite die members.

The maintenance of close limits on extended dimensions of large castings—lengths of, say, 12 or 15 inches—is only possible if all fluctuations in operating conditions are closely controlled. Pertinent conditions include metal temperature, die temperature, and the temperature at which the casting is ejected. Variations in dimensions for different temperatures are shown in the accompanying table.

The need for such control may tend to slow down production to some extent, and often the necessity of avoiding distortion at ejection may also reduce the rate of output.

Apart from the tolerances to be held, it is indisputable that many large components can be more efficiently produced if some of the smaller holes, particularly those near the periphery, are left solid and subsequently drilled. In many cases they are cleared or deburred by drills, so that the addition to the secondary costs is small. The reduced likelihood of distortion at ejection also enables a faster production rate to be maintained. With small parts, where the over-all contraction is less and the casting does not tend to bind tightly on the cores, there is, of course, nothing to be gained by omitting cored holes.

Checking Screw Threads

The gaging of screw-threaded die-castings presents no difficulties where the casting is screwed out of the cavity, provided that the pitch has been corrected to allow for contraction. Even this precaution is not essential if there are less than about three full turns of thread. Split threads, on the other hand, are less easy to check with the normal type of ring gage. The difficulty is due to the fact that very small misalignments of the two cavity halves result in the flanks of the thread wedging in the gage.

It is doubtful if the use of a ring gage is worth while once sample castings have been checked for thread form and approved. The only appreciable dimensional error that can occur is in the diameter across the parting line, and this can be checked with a plain gap gage. Axial misalignment—the staggering of the thread form at the parting line—is always clearly evident and is, in fact, emphasized by the scoring that occurs during trimming. Where registration is accurate, trimming merely leaves a bright line, of the same thickness as the flash, but any displacement results in the thread flank being scored for an appreciable distance. Castings with excessive errors can accordingly be detected by visual inspection.

INGENIOUS *Mechanisms*

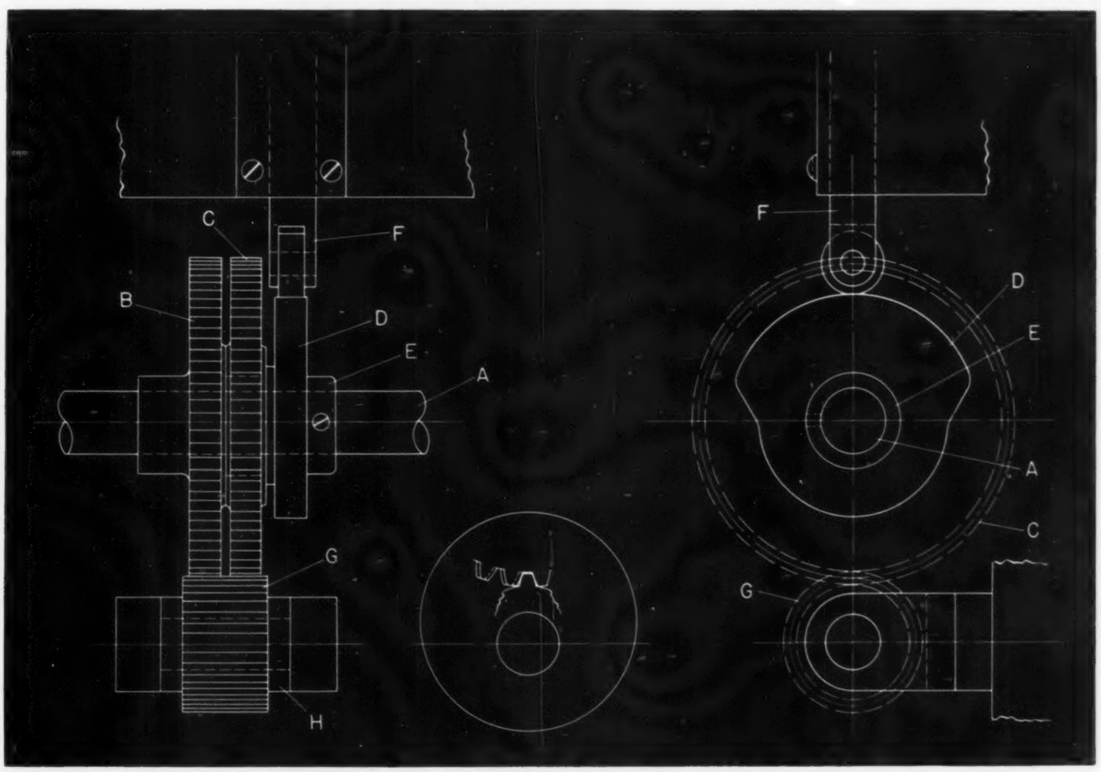
Mechanisms selected by experienced machine designers as typical examples applicable in the construction of automatic machines and other devices

Gear Mechanism for Varying Cam Timing

By Louis Kasper, Philadelphia, Pa.

On a machine that manufactures a woven-wire product, it was necessary to provide for varied spacing in the weave. This was accomplished by means of a cam-actuated mechanism which is here illustrated. The cycle of the mechanism is controlled by shaft *A* to which gear *B* is keyed. Gear *C* is fixed to the hub of cam *D* which rotates freely on the shaft and is positioned by collar *E*. Cam *D* operates the follower bar *F* which actuates the spacing mechanism. Pinion *G* is supported to rotate freely on bearing bracket *H* and mesh with gears *B* and *C*. Gear *B* is of standard pitch and has fifty teeth. Gear *C* has fifty-one teeth but the same outside and pitch diameters as gear *B*. The additional tooth, however, decreases the circular pitch since the width of the teeth must be narrower than standard.

In operation, shaft *A* rotates gear *B*, the motion being transmitted to gear *C* through pinion *G*. Since gear *C* rotates slower than gear *B*, due to the difference in the number of teeth, cam *D*, actuated by gear *C*, will turn less than one revolu-



A cam action which produces varied spacing in a woven product.

tion in relation to gear *B*. In the situation described, the loss in radial movement would be approximately 7 degrees, and shaft *A* would require fifty-one turns to produce a complete timing cycle of cam *E*. The modification of gear *C* is restricted by its relation to pinion *G*. Since the teeth of gears *B* and *C* must remain in alignment as they mesh with the pinion gear, the reduction in the thickness of the teeth of gear *C* must be sufficient to prevent any binding action.

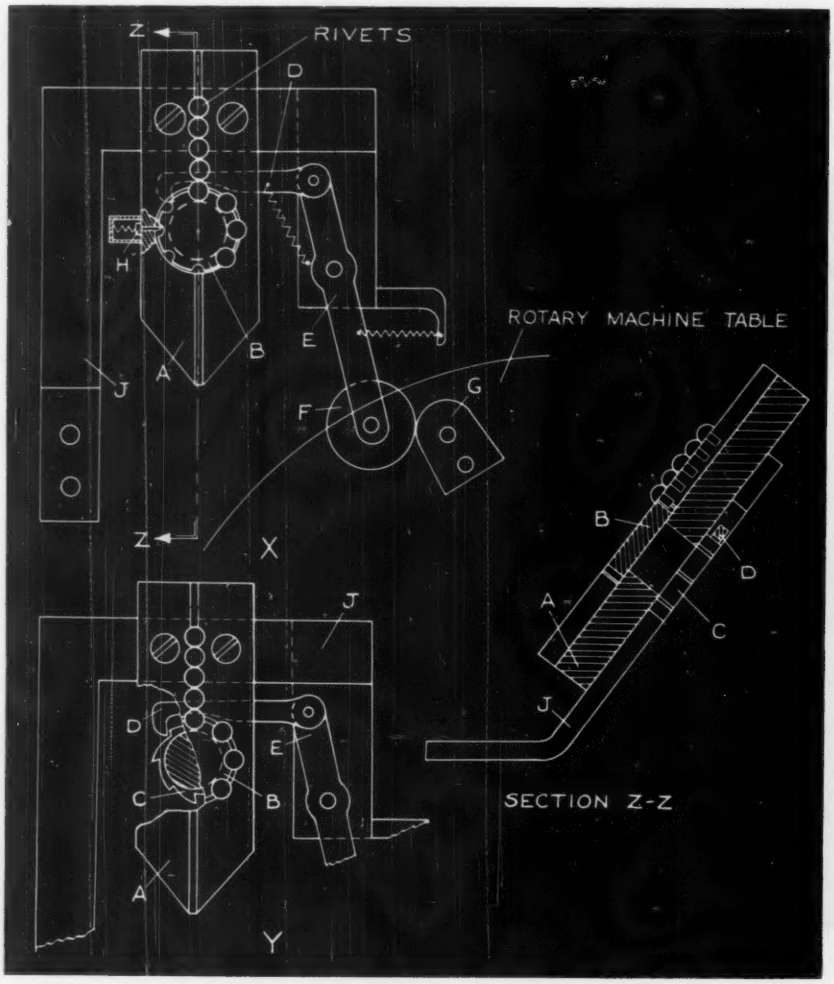
Semi-Automatic Feeding Device for Small Headed Parts

By FEDERICO STRASSER, Santiago, Chile

For a particular application, it was necessary to form a longitudinal knurl on the shanks of small rivets. One half of the knurling die employed was mounted in a fixed position on the frame of a threading machine, while the other half was mounted on the rotary machine table. It was still necessary to provide a device for introducing a single rivet into the die at each revolution of the table.

Satisfactory operation was obtained with the feeding device illustrated. The main member of the device is central body *A*. A channel, wide enough to accommodate the rivet shanks freely, is milled centrally down the upper surface of the member. With the center of the channel serving as one locating line, a hole is drilled through the body and counterbored to receive transfer wheel *B*, as shown at X in the illustration. Around the periphery of the transfer wheel are machined eight equally spaced slots of a size suitable for carrying the rivet shanks.

A ratchet wheel *C*, which may be seen at Y, is mounted on the under side of the transfer wheel. The remaining parts of the advancing mechanism are ratchet *D*, lever *E*, roller *F*, and actuating finger *G*. Two tension springs are included to insure proper functioning of the lever system. A spring-loaded pawl *H* restricts rotation of the transfer wheel to a clockwise direction. All of these units, with the exception of actuating finger *G*, are mounted on a welded-steel support frame *J*, which is situated at an incline of approximately 35 to 40 degrees from the horizontal. This support frame is bolted directly to the frame of the machine. Actuating finger *G* is screwed to the rotary



Feeding device synchronizes rivet flow with rotation of the machine table.

machine table on which the moving member of the knurling die is mounted.

With the machine functioning, the operator loads the upper portion of the channel in central body *A* with the rivets to be knurled. The rivets are placed with their shanks down as shown in section Z-Z, being supported on the under side of their heads. Normally, four of the eight slots in transfer wheel *B* contain rivets. When actuating finger *G* contacts roller *F*, lever *E* pivots on pin *K*. Ratchet *D* is, in turn, pulled to the right, engaging a tooth on ratchet wheel *C* and rotating the transfer wheel one-eighth of a revolution in a clockwise direction. A rivet is thus aligned with the lower portion of the channel in the central body and, due to the force of gravity, travels downward to the knurling die. As the actuating finger passes by the roller, lever *E* and ratchet *D* are returned to their original position by means of the two tension springs.

Eccentric Driving Mechanism Permits Stroke Adjustment During Operation

By W. M. Halliday, Southport, England

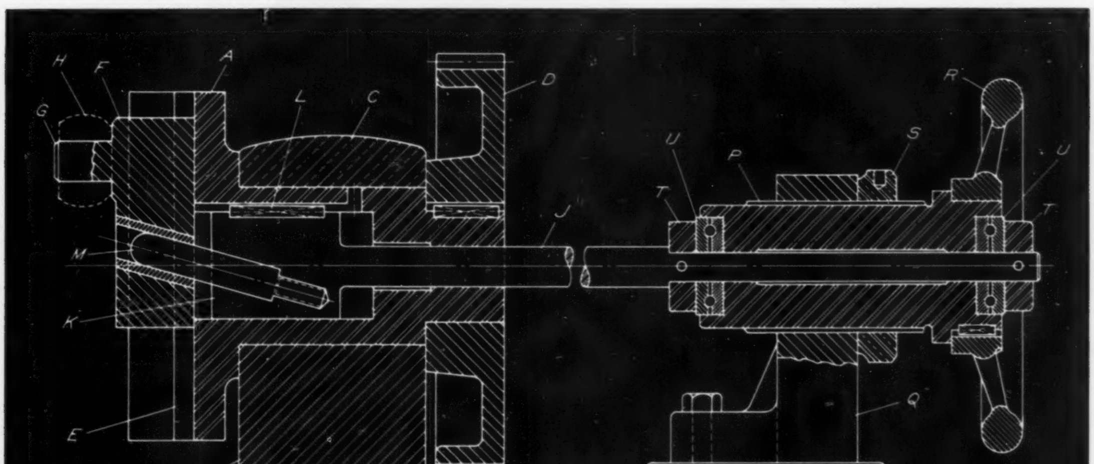
Small variations in the stroke length of a reciprocating slide can be made while it is operating, by means of the mechanism illustrated. Driving disc *A* has an integral shank revolving in fixed bearing *B*, where it is retained by bearing cap *C*. Driving gear *D*, keyed to the shank, revolves continuously.

The disc face contains a dovetail *E* milled across its diameter. Crankpin block *F*, fitting the dovetail, has an integral crankpin *G*, over which is fitted one end of a connecting-rod *H*. At its other end, the rod is attached to the reciprocating slide (not shown).

Rod *J*, by which the device is adjusted, has a shouldered section *K* fitting the bore of disc *A*. Straight key *L* causes the rod to revolve with the disc yet permits a short axial movement of the rod along the bore. A hard pin *M* is pressed at an angle into the end of section *K*. This pin engages a hole that is drilled in the crankpin block.

Rod *J* extends any convenient distance to a control point. At its right end, the rod is reduced in diameter and is fitted to sleeve *P*. An external thread along the sleeve engages the threaded internal bearing surface of angle-bracket *Q*. By revolving handwheel *R*, keyed to the sleeve, the sleeve can be adjusted axially in relation to the angle-bracket. Threaded ring *S* locks the sleeve, once it has been adjusted. Rod *J* moves axially in unison with the sleeve, by means of the stop collars *T* and thrust bearings *U*.

If the stroke of the slide has to be lengthened, ring *S* is released, and the handwheel revolved counterclockwise. This movement is transmitted to the rod, and pin *M* is retracted a corresponding amount from the crankpin block, causing the block to move radially outward in disc *A*. Thus, crankpin *G* has a greater throw. By revolving the handwheel clockwise, the throw of the crankpin is similarly decreased.



By revolving handwheel (R), the throw of crank pin (G) can be varied without stopping the slide.

TOOL ENGINEERING *Ideas*

Tools and fixtures of unusual design and time- and labor-saving methods that have been found useful by men engaged in tool design and shop work

Eccentric Adapter for Lathe Chuck

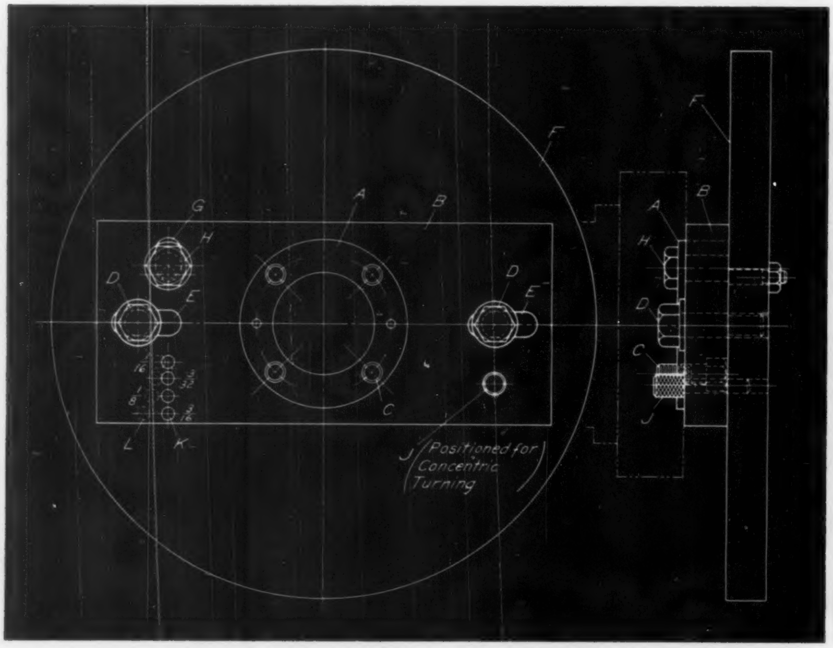
By William M. Foster, New Hyde Park, N. Y.

An adjustable adapter designed for use with a chuck permits either concentric or eccentric turning. The adapter, which is shown in the accompanying illustration, is a movable member that is sandwiched between a standard lathe chuck and faceplate.

Ring *A* is doweled to a rectangular movable plate *B*. Four screws *C* pass through both the ring and the plate from the rear and engage the existing threaded holes in the back face of the chuck (shown in broken lines). The outside diameter of the ring is calculated to provide a good fit in the back recess of a chuck. A clearance hole is bored through the center of the plate to facilitate the gripping of long work-pieces.

Two bolts *D* pass through elongated holes *E* in plate *B* and are threaded into faceplate *F*. The shoulder portions of the bolts that contact the elongated holes are ground and serve as guide pins. A third elongated hole *G*, lying at a right angle to the first two, receives eccentric stud *H*. Movement of the stud will force plate *B* either to the left or to the right to effect the desired adjustment. A standard hexagonal head is provided on the stud to simplify adjustment.

When movable plate *B* is positioned so that ring *A*, and therefore the chuck, is aligned with the lathe spindle, locating pin *J* can be inserted into a hole in the plate and will pass into a corresponding hole drilled into the faceplate. After tightening bolts *D*, the device can be used for conventional turning. Adjustment of the movable plate for eccentric turning when any of four commonly used offsets—1/16, 3/32, 1/8, or 3/16 inch—are required can be accomplished by means of locating holes *K*.



Adjustable adapter fits between standard lathe faceplate and chuck to permit eccentric turning of work-pieces.

Drilled into the faceplate, and on the same horizontal center line as the locating holes, are four corresponding holes *L*. Each of the holes *L* is spaced so that, when aligned with its respective hole in plate *B*, the chuck will be located off-center by the distance stamped on the plate. These distances can, of course, be chosen to suit the particular needs of the individual shop. To insure proper alignment of the holes, locating pin *J* is inserted. Bolts *D* can then be tightened to secure the position.

Offset adjustments are not limited to the fixed spacing of holes *L*. Plate *B* can be set at any position within the limits of slots *E*. Counterweights can be attached to the faceplate for high-speed operation.

Internal Grooving Tool with Positive Depth Control

By William H. Morson, Birkdale, England

An inexpensive, yet efficient, internal grooving tool developed for use on lathes or drill presses is shown in the accompanying illustration. This tool has a simple adjustable means for accurately producing annular grooves of various depths in the bores of work-pieces.

The device is assembled on a spindle *A*, the shank end *B* of which is ground to the taper of the machine quill in which the tool is to be used. Mounted on spindle *A* is a flanged housing *C*, having an outside diameter slightly less than the blind bore in work-piece *X*, in which annular groove *Y* is to be machined.

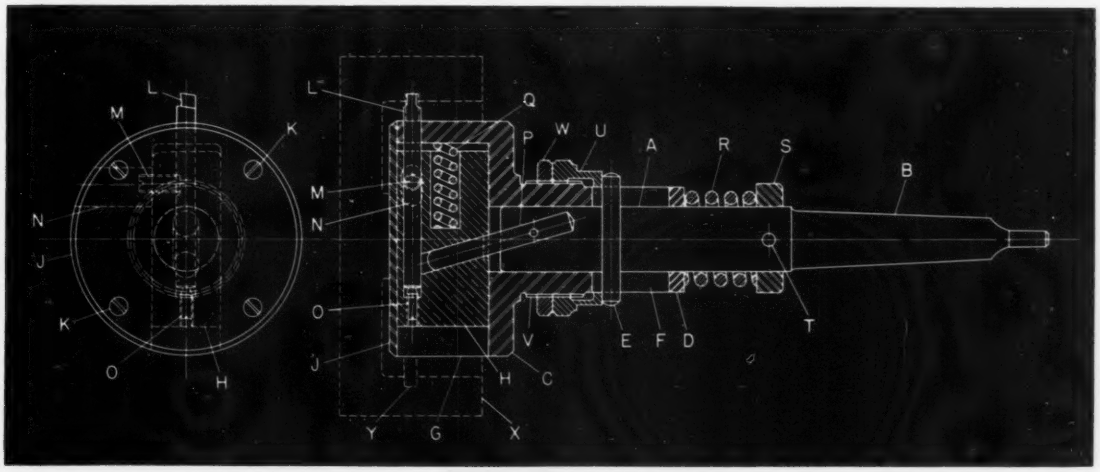
Integral with flange *C* is a hub *D* that is bored concentrically to be a close sliding fit over the parallel portion of spindle *A*. Flange *C* is prevented from rotating on the spindle by driving pin *E* that is press-fitted into a hole drilled diametrically through the spindle. Each projecting end of the pin passes into elongated slots *F* which are machined through opposite sides of hub *D*.

A deep rectangular slot *G* is machined centrally in the left-hand end of flange *C* so as to pass through one side of the flange and terminate close to the edge of the other side. A close-fitted rectangular steel slide *H* is set to move smoothly within this slot. The slide is held against the bottom of the slot by a thin steel disc *J* which is affixed to flange *C* by four countersunk flat-head screws *K*.

The cutting tool *L* has a long cylindrical shank that fits closely into a drilled hole extending the full length of slide *H*. A hole in the wall of flange *C* provides additional support for the front of the tool. The cutting tool can be fixed at any required radial setting by headless screw *M*, located in the side of slide *H*.

An elongated slot *N* is machined through the adjoining wall of flange *C* to afford access for adjusting and locking screw *M*. Slot *N* is sufficiently long to clear the projecting end of this screw at all points throughout the normal traversing movement of slide *H*. Cutting tool *L* can be advanced or retracted by means of set-screw *O* in the lower end of the slide. The set-screw has fine pitch threads to permit making precision adjustments.

Pin *P* is press-fitted and doweled in an angular



Internal grooving tool with an adjustable stop for controlling the depth of grooves machined in the bores of work-pieces.

blind hole in spindle *A*. The opposite end of this pin is a sliding fit in another angular hole in slide *H*. The lateral movement of slide *H* is derived from the pressure exerted on this member as pin *P* and spindle *A* are advanced and retracted. A blind hole is machined in one end of slide *H* for compression spring *Q*, the opposite end of which bears against the wall formed by slot *G* in the flange. A second coil spring *R* fits freely over spindle *A* between hub *D* and collar *S*. The collar is permanently fastened to the right-hand end of the spindle by dowel *T*.

Member *U* is a steel adjusting-ring that screws over the threaded portion *V* of hub *D*. A threaded lock-ring *W* is used to position adjusting-ring *U* according to the depth of the groove required. By altering the longitudinal setting of ring *U*, the lateral movement imparted to slide *H*, and thus the amount of penetration of cutting tool *L* into the work-piece, can be controlled as required.

In operation, the grooving tool is fed by the tailstock spindle into the bored hole in the work-piece until disc *J* bears against the back face of the bore. Continued inward movement of the tailstock spindle causes the spindle *A* to slide into flange *C*. Springs *Q* and *R* are compressed, forcing pin *P* farther into the hole in slide *H* and thereby moving the latter gradually outward. Cutting tool *L*, affixed in the slide, is therefore advanced and commences cutting into the surface of the bore to form groove *Y*. This cutting action continues until spindle *A* has passed sufficiently into the flange to bring driving pin *E* into contact with the end of ring *U*, as illustrated in the diagram.

After the groove is machined, the tailstock spindle is retracted, whereupon springs *Q* and *R* expand, holding flange *C* in the bored hole, and slide *H* and cutter *L* withdraw into the flange housing under the impetus of pin *P*. Spindle *A* continues to move to the right until pin *E* bears against the back ends of elongated slots *F*. The complete device will then take up the retracting movement of the tailstock spindle, and flange *C* will be withdrawn from the bore in the work-piece.

V-Block with Locator for Repeat Work

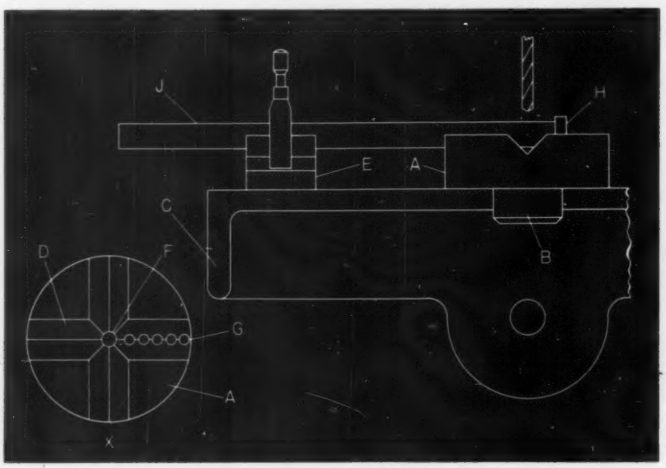
By J. Randolph Lucas, Richmond, Va.

A V-block with an adjustable work stop can be a great time saver. With such a device, any number of parts can be drilled with the hole located in the center of a shaft and at the required distance from the ends.

The accompanying diagram shows a special V-block *A* which has a shoulder *B* turned to fit the clearance hole found in the drill press table *C*. Two V-grooves *D* machined 90 degrees from each other, as seen in view *X*, cross in the center of the block. The grooves are cut to the same depth as the groove in the standard V-block *E*. Hole *F* is bored through the center of V-block *A*.

Holes *G* are drilled the required distances from the center hole *F* of this V-block. These holes receive a dowel *H* that serves as the work stop. Work *J* is thus supported by V-blocks *A* and *E* and located by dowel *H*.

Additional lengths of work may be accommodated by drilling holes for stop *H* in required locations in the unused portions of the V-grooves in block *A*.



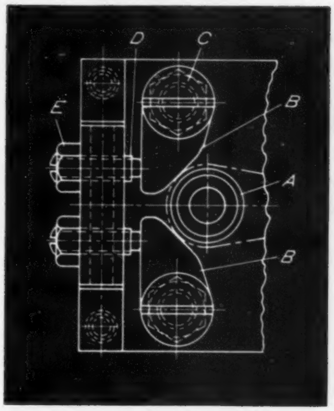
Special V-block which is provided with an adjustable dowel for locating shafts lengthwise.

Ideas for Shop and Drafting-Room

Drill Jig Has Adjustable Locators

By Cliff Bossmann, Dayton, Ohio

When jig-drilling a hole through the pad of a cast link, it is necessary to locate the work from the unmachined periphery of the pad. To compensate for dimensional variations in this surface from one lot of castings to another, the illustrated jig was designed with adjustable locators.



Because locators (B) can swivel, this drill jig is adaptable to dimensional changes in the periphery of the work.

A preparatory operation consists of machining both faces of the pad *A*. In the drill jig, the pad is positioned against the two locators *B*. These members are able to swivel around the cap-screws *C*. When the first piece in each lot is placed in the jig, set-screws *D* are adjusted and secured by lock-nuts *E* to position the link in required drilling position. When a subsequent lot requires a resetting, it is a simple matter to release the set-screws and swivel the locators slightly.

Steel Ball Used to Measure Chamfer Diameter

By George G. Herzl, Philadelphia, Pa.

The large diameter of a chamfer can be measured accurately by using a steel ball of a suitable size seated on top of a chamfer. To find the dimension c, as shown in the illustration, a comparator is employed to first determine the height of the ball above the top edge of the chamfer. If the diameter of the ball used is 2 inches, the chamfer diameter may then be found by subtracting m from d to obtain dimension h and referring directly to the tables "Segments of Circles" in Machinery's Handbook.

If the ball diameter is other than 2 inches, either of two systems can be used to find the value c. The following formula may be used to find c by calculation: Given h and r,

$$c = 2\sqrt{h\,(2\,r - h)}$$

In the second method, the value for h is divided by one-half the diameter of the measuring ball, thus obtaining an h equivalent for a ball 2 inches in diameter, that is:

$$h_{e} = \frac{h}{\frac{d}{2}}$$

The corresponding value for c found in the tables in Machinery's Handbook is then multiplied by one-half the ball diameter to obtain the desired chamfer diameter, that is:

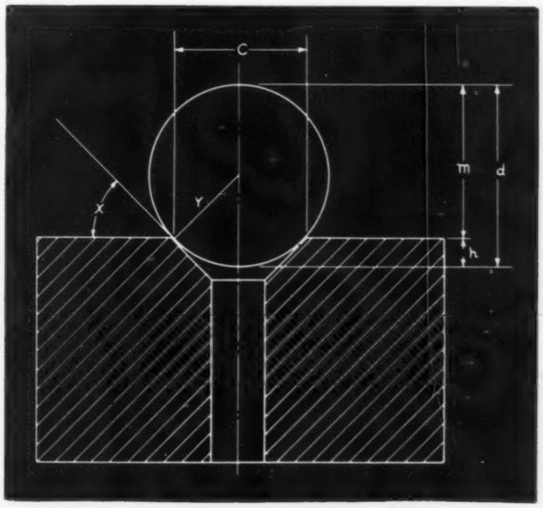
$$c = c_{e} \times \frac{d}{2}$$

The minimum ball diameter is easily determined visually. It can be calculated by using the following formula:

$$d = \frac{c}{\sin x}$$

For 30 degrees, 45 degrees, and 60 degrees, d equals 2 c, 1.41 c, and 1.16 c, respectively.

In the inspection of a large number of parts, both limit measurements are set directly on the comparator dial.



The large diameter of a chamfer can be found by using a steel ball, tables in *Machinery's Handbook*, and simple formulas here given.

Materials OF INDUSTRY

The properties and new applications of materials used in the mechanical industries

Molybdenum-Base Alloys for Use at Elevated Temperatures

Four molybdenum-base alloys with high structural strength at elevated temperatures have been made commercially available by the Climax Molybdenum Co., 500 Fifth Ave., New York 36, N.Y. These are: 0.3 per cent columbium—balance molybdenum, 0.5 per cent titanium—balance molybdenum, 1.0 per cent vanadium—balance molybdenum, and 2.0 per cent tungsten—balance molybdenum. The outstanding property of these alloys is their strength above 1600 degrees F.

Use by designers of gas turbines and other high-temperature parts should result in increased power and efficiency of aircraft and missiles. Other applications include electrodes and auxiliary equipment for glass-melting furnaces and piercing points used in the manufacture of seamless tubing. The Climax Molybdenum Co. is producing workable ingots by its arc-cast process in which molybdenum powder is melted and cast in a vacuum with an electric arc supplying the heat.

Fire-Resistant Hydraulic Fluid That Eliminates Fire Hazards

An economical "snuffer" type hydraulic fluid with fire-resistant qualities that prevent it from burning on contact with flames, heated metal surfaces, or molten metal has been made available by the Shell Oil Co., 50 West 50th St., New York 22, N. Y. Called "Irus Fluid 902," it is formulated from water, petroleum, hydraulic oil, and emulsifying agents.

The fluid is noncorrosive on ferrous and most non-ferrous metals and is compatible with normal system components. Its film strength provides good antiwear and antiscuff protection for closely fitted machine parts. High shear rate viscosities assure maximum hydraulic efficiency over a wide temperature range. The fluid is colored a bright yellow to permit instant recognition and location of possible leaks.

This fluid is particularly suitable for use in industries where hydraulic leaks or line ruptures would be immediate fire or explosion hazards, eliminating the possibility of combustion by releasing its water content as a protective steam blanket to quench fire.

Fabric for Protecting Low-Pressure Laminates

A fabric overlay that protects low-pressure laminates from chemicals, abrasion, and weathering has been announced by the Textile Fibers Department, Carbide and Carbon Chemicals Co., a division of Union Carbide and Carbon Corporation, 30 East 42nd St., New York 17, N. Y. This fabric, called "Dynel," can be used with polyester and phenolic or epoxy resin laminates. Overlays can be made with this material on either or both sides of the laminate. Dynel has a tensile strength of 40,000 to 57,000 pounds per square inch, a low moisture absorbency (less than 0.4 per cent), and chemical resistance to both acids and alkalies.

Uses include the overlaying of glass-reinforced laminates throughout the chemical field as well as for products such as boat hulls, aircraft assemblies, automobile bodies, structural panels, machine tool parts, and many other items.

Plates and Sheets of Neutron Shielding Material Available

The availability of "boral," a neutron shielding material important to atomic energy installations, has been announced by the Aluminum Company of America, 1501 Alcoa Building, Pittsburgh 19, Pa. The name boral has been coined from its ingredients, boron carbide and aluminum. It exhibits qualities that make it ideal as a component for shields to control speeding neutrons in nuclear reactors. The product is available in standard sizes of 48 inches by 120 inches and 36 inches by 96 inches in thicknesses of 1/8 and 1/4 inch. Boral plate and sheet are available in two standard tempers—annealed and as fabricated. The "O" or annealed temper is recommended for applications involving forming. A boral plate 1/4

inch thick, according to the Atomic Energy Commission, has an effective shielding power equal to that of a concrete slab 100 times greater in thickness.

Material Developed for Making Super Permanent Magnets

Powerful permanent magnets which are made from a finely ground, virtually 100 per cent pure manganese-bismuth embedded in a plastic matrix have been developed by the Westinghouse Electric Corporation, Box 2278, Pittsburgh 30, Pa. One of the advantages of these magnets is their unusual resistance to demagnetization. This resistance is the result of a magnetic property called "high coercive force" which is not adversely affected by external magnetic fields.

With this material it is practical to make permanent magnets in a wide variety of shapes, particularly in the form of thin wafers or discs. Plastic magnets may easily be drilled, tapped, and cut. Their use can eliminate expensive machining operations. The plastic binder of this magnetic material is an electrical insulator, and, therefore, the magnets are nonconductors of electricity.

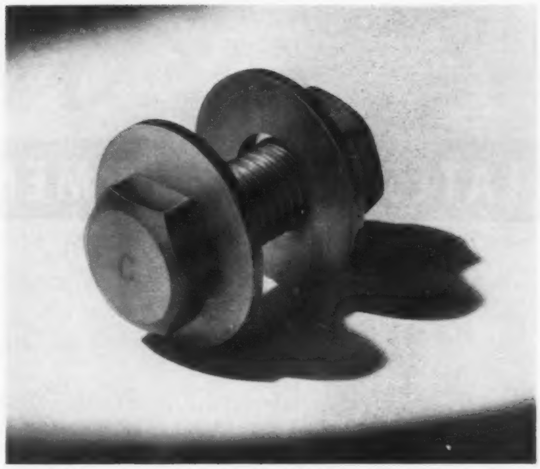
High-Strength Nylon Pipe That Withstands High Temperatures

A nontoxic nylon pipe, called "Tempertube," which has a high bursting strength and the ability to withstand high temperatures, has been placed on the market by the Danielson Mfg. Co., Danielson, Conn. This pipe is produced in straight lengths or continuous coils in sizes from 3/8 inch to 1 1/2 inches outside diameter with wall thickness from 0.025 inch to 0.125 inch.

The pipe is available in two formulations of nylon, one being Zytel 42 and the other Caprolaptam. The Zytel 42 tubing has the greater burst strength, rigidity, and resistance to high temperatures. The Caprolaptam pipe has a higher impact strength, with somewhat lower tensile strength and stiffness, but has high qualities of resistance to bruising and is very easy to bend. Tensile strengths are highest at low temperatures and vary from 15,700 pounds per square inch at −67 degrees F. to 7400 pounds per square inch at 158 degrees F. Both types have a specific gravity of 1.14.

Silicon Bronze Fasteners That Resist Sub-Zero Temperatures

Silicon bronze fasteners, such as hexagon-head screws, nuts, and washers, that resist sub-zero temperatures and are not affected by corrosion have been announced by the Cleveland Cap Screw Co., 3002 East 79th St., Cleveland 4, Ohio.



Corrosion-resistant silicon bronze fasteners such as this can be easily assembled in sub-zero temperatures according to the Cleveland Cap Screw Co.

One application in which these fasteners have proved highly successful is in the assembly of radar domes in the combined American-Canadian radar system called the Distant Early Warning system or Dew Line. Four thousand and five hundred of these fasteners, having a 1/2-inch diameter and 1 1/2-inch length, are used in each radar dome.

Liquid Neoprene Provides Protection for Structural Steel Shapes

Neoprene rubber in a liquid form suitable for brushing or spraying, which provides protection against acids, caustics, and solvents, has been announced by the Wilbur & Williams Co., 130 Lincoln St., Boston 35, Mass. Called "Rubber-Coat Liquid Neoprene," it finds ready use in the painting of air-conditioning equipment, louvers, concrete foundations, tanks, food equipment, marine equipment, etc. It is available in four colors: black, red, light gray, and aluminum.

Powder-Metallurgy Compound for Oil-Retaining Bearings

A powder-metallurgy compound developed for the production of oil-retaining bearings has been made available by the Bound Brook Oil-Less Bearing Co., Bound Brook, N. J. "Compo-E," as it is called, is composed of approximately equal parts of iron and bronze. It combines the strength of iron with the antifriction and long-life properties of bronze. Although it is primarily a bearing material, it can also be fabricated into sintered structural parts. It is finding widespread use in fan motors, air-conditioning motors and drives, record players, tape recorders, and home laundry equipment.

LATEST DEVELOPMENTS IN *Shop*

Rockford Long-Stroke "Hy-Draulic" Slotting Machine

A Model SA "Hy-Draulic" slotting machine having a 36-inch stroke is being manufactured by the Rockford Machine Tool Co., Rockford, Ill. This model is an especially rugged, accurate machine designed to facilitate the handling of large, awkward work having irregular sections and internal surfaces. It will take both angular and rotary cuts.

A unique feature of this machine is the combination of mechanical leverage and hydraulic control for the ram drive. The patented torque-arm drive permits an infinite speed adjustment from 40 to 100 feet per minute with constant horsepower characteristics. Speeds below 40 feet per minute are made available by means of a flow control valve. Ram reversals are fast, smooth, and accurate over the full operating range of the machine. The entire machine is built to regularly perform heavy-duty slotting work.

All machine controls are located within easy reach of the operator. Cutting speed and all power movements for the machine are controlled at the overhanging pendant. Any cutting speed within the available range may be obtained through simple adjustment. A cutting indicator on the column shows the approximate ram speed in use. Start and stop levers are installed on both sides of column.

The machine has a wide range of longitudinal and transverse table travel, plus 360-degree rotary table movement. A dividing head provides for the accurate spacing of keyways, serrations, gear teeth, and other jobs requiring precision indexing.

Other features include power

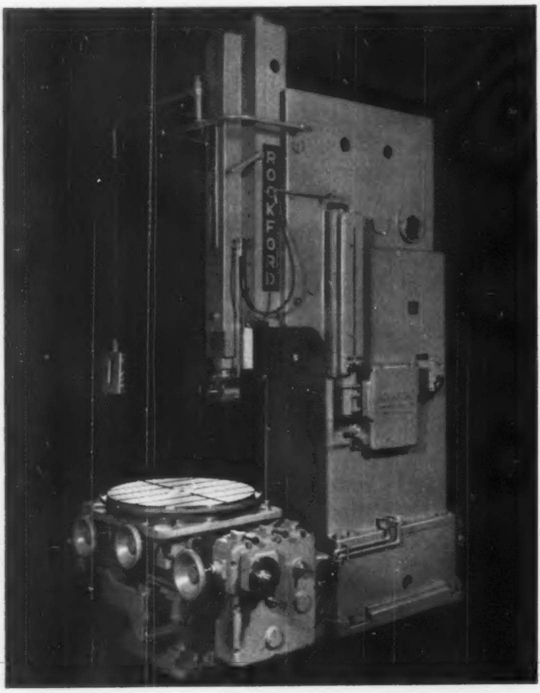


Fig. 1. Rockford Model SA, 36-inch stroke "Hy-Draulic" slotting machine for large work-pieces

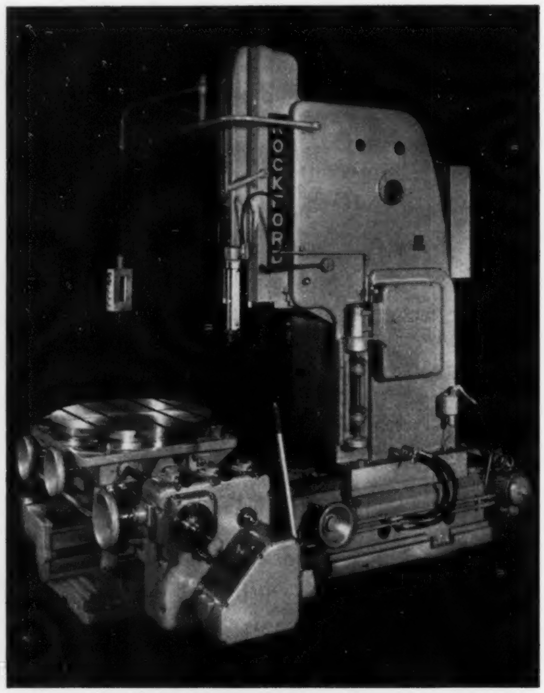
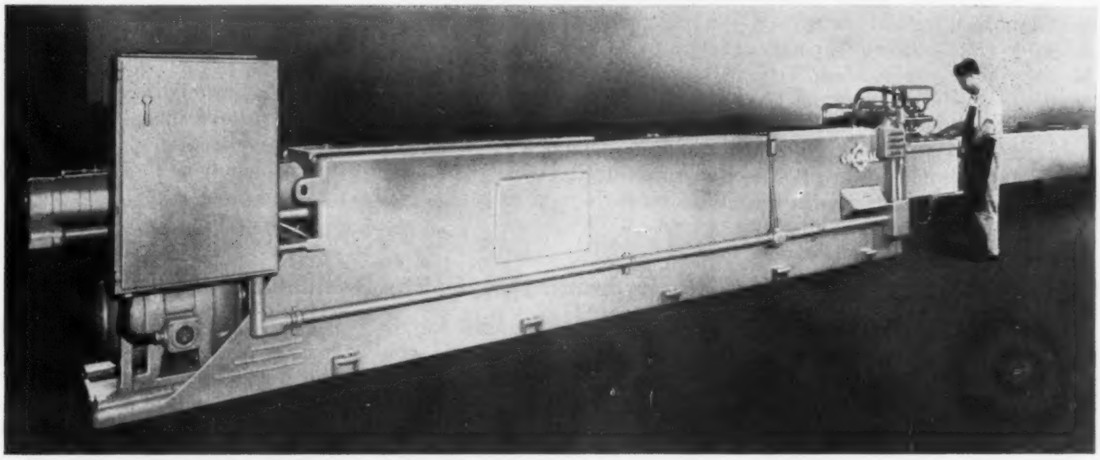


Fig. 2. Model SA, 20-inch stroke "Hy-Draulic" slotting machine with traveling column

Equipment

Machine tools, unit mechanisms, machine parts, and material-handling appliances recently placed on market

Edited by FREEMAN C. DUSTON



Colonial long-stroke universal hydraulic broaching machine

rapid traverse in all directions, stroke length adjustment when the ram is in motion, and a mechanically balanced ram with a tilt of 10 degrees from vertical. Positioning or adjustment of the ram involves three steps. These consist of: first, angular position of the ram; second, height of the ram as established by position of the ram housing in relation to the table; and third, length of ram stroke. The ram-stroke control is mounted on the side of the column, and the ram stroke can be adjusted and set any time to suit the work.

A 15-H.P., variable-delivery, radial piston pump of latest design supplies hydraulic power. Electrical equipment is standard, single-direction, with simple conventional control. The main castings are of semisteel, adequately ribbed for maximum rigidity. Automatic pressure lubrication is provided for the ram, bed, and saddle ways.

Circle Item 101 on postcard, page 225

Colonial Broaching Machine

The Colonial Broach & Machine Co., Detroit, Mich., recently built a universal, hydraulic, horizontal broaching machine designated HAS-15, which has a stroke of 10 feet and is over 36 feet long, including the chip trough. The machine is equipped to cut opposed 0.085-inch deep V-grooves in carriage-rail assemblies for complex modern business machines. All sizes are broached on the same machine—from the longest to the shortest, which requires only an 11-inch cut—using the same broach inserts. One groove is cut in steel, while the other one is cut in a cast-iron insert.

Circle Item 102 on postcard, page 225

Hardsurfacing Flux

The Lincoln Electric Co., Cleveland, Ohio, has added an H-560 flux to its line of hardsurfacing agglomerated alloy fluxes. This flux is used with the submerged-arc welding process to produce a hardsurfacing deposit employing a mild-steel electrode. It is an agglomerated mixture of fluxing materials and alloys which will produce a high-carbon, high-alloy weld deposit when used with Lincoln's L-60 mild-steel automatic electrode wire. Alloys are added to the weld deposit through the flux. Agglomeration bonds the flux and alloy particles together—each H-560 particle having flux and alloys in proper proportion.

The deposit has a hardness of 53 to 61 Rockwell RC, cannot be torch-cut or forged, resists scaling and flaking, and retains a highly polished surface when subjected to metal friction. The hardness and abrasion resistance are unaffected by the cooling rates normally encountered in welding.

The flux is suitable for the fabrication and maintenance of wearing parts where the service involves severe abrasion and medium impact. It will perform successfully under abrasive conditions at 1100-degree temperatures.

Some typical uses for H-560 include the hardsurfacing of crushing rolls and rings of various types, as used in the coal, rock, cement, and clay industries; Banbury mixer parts, as used in the rubber industry; and lining the inside of catalyst towers, pipe, ball mills, shredder housings, sewer tile dies, extruder piston heads, pug mill knives, augers, coke pusher shoes, and ore and coal chutes.

Circle Item 103 on postcard, page 225

Improved Line of Red Ring Gear-Shaving Machines

An improved line of Red Ring, Model GCU, 8- and 12-inch rotary gear-shaving machines featuring a new column design and built-in push-button electrical controls is available from National Broach & Machine Co., Detroit, Mich. Tunnels cast in the columns of the improved machines provide space for electrical controls and permit compact flush-mounting of the push-button control panels in the top of the columns within easy reach of the operator. The new design also has a separate cutter drive gear-box at top of column.

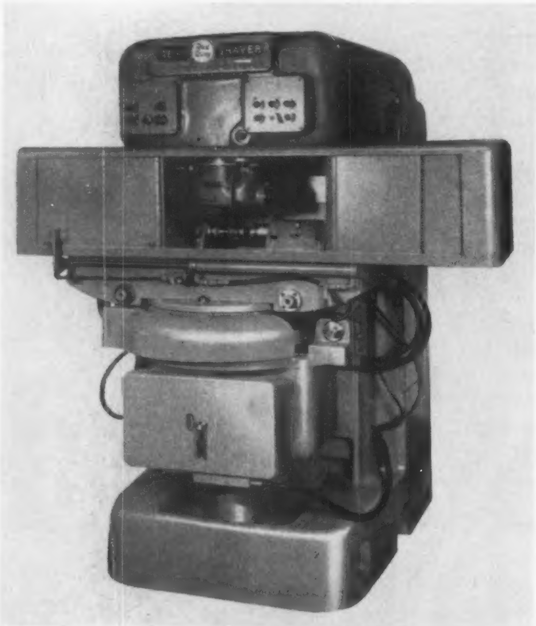
The illustrated Model GCU 8-inch machine is equipped for semi-automatic loading and shaving of a helical transmission gear. This machine will shave spur or helical gears up to 4 diametral pitch having pitch diameters from 1 to 8 inches. The Model GCU 12-inch improved machines shave spur or helical gears up to 4 diametral pitch with pitch diameters from 1 to 12 inches. Both models are made in three different types: one, a universal machine that provides for conventional shaving of gears, including crowned and tapered gears, and diagonal shaving with two-stroke or multi-stroke cycles that can also be performed in conjunction with an automatic differential upfeed on the universal type machines; two, a type which resembles the universal model except that it does not include crowning or taper shaving attachments; and three, a type which provides only for basic diagonal shaving with the two-stroke cycle. Both models have motor-driven cutters that drive the work gears, which are usually mounted on plugs or centers.

A 3-H.P. motor drives the cutter; a 1/2-H.P. motor, the table; and a 1/4-H.P. motor, the coolant pump. The electrical control panel built into the machine casting is accessible through a hinged door at the side of the machine. The machines occupy a floor space approximately 66 by 61 inches.

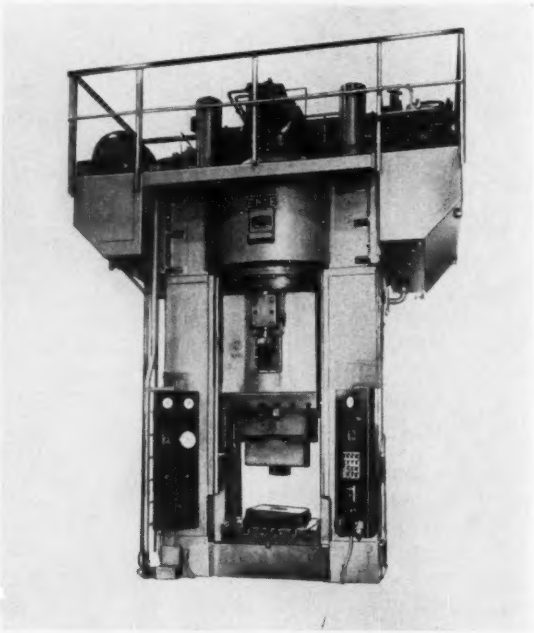
Circle Item 104 on postcard, page 225

Erie Hydraulic Forging Press with Electromagnetic Controls

A 1500-ton hydraulic forging press with electromagnetic controls has been announced by the Erie Foundry Co., Erie, Pa. This machine is designed to respond instantly to light, finger-tip pressure on the electromagnetic controls which are grouped on a conveniently located panel. The press is arranged for semi-automatic operation so that the forging cycle can be pre-set for any advance, press, release, return speed, and tonnage characteristics desired. It can also be operated by a manual control that can be easily detached



Red Ring Model GCU 8-inch gear-shaving machine of improved design



Hydraulic forging press brought out by the Erie Foundry Co.

"Sesco-Matic" stock lubricator, feeder, and cut-off unit made by Sesco, Inc.

Milling machine and tracer attachment manufactured by the U. S. Burke Machine Tool Division

from the control panel for operation at any nearby position. This remote-control feature is especially valuable when checking die alignments from all four sides of the press.

The press utilizes hydraulic knockouts which can be set to eject the forging from the die at any position in the cycle. The guide system can be easily adjusted to insure accurate die alignment. The press is designed for no-draft, non-ferrous forgings, and is available in other sizes and with modifications to suit any hydraulic press forging requirements.

The platen is 48 by 48 inches; opening, 60 inches; stroke, 48 inches; and ram diameter, 38 inches. The machine weighs about 260,000 pounds and has a base 13 feet 7 inches by 7 feet 2 inches.

Circle Item 105 on postcard, page 225

"Hi-Spiral" Combination Center Drills

"Hi-Spiral" center drills made in regular and arbor types by the Circular Tool Co., Providence, R.I., can be furnished from stock in standard diameters and lengths and can also be made in special sizes to order. It is made of high-speed steel and designed to facilitate clearing chips in order to obtain superior finish.

Circle Item 106 on postcard, page 225

Stock Lubricator, Feeder, and Cut-Off Unit

Sesco, Inc., Detroit, Mich., has brought out a stock lubricator, feeder, and cut-off unit called the "Sesco-Matic" for use in the fabrication of cabinets, work-benches, tables, shelves, sinks, and similar equipment. It is claimed that this unit permits feeding presses with stainless steel, aluminum, and brass, as well as any highly polished stock, without danger of scuffing or scratching. The unit, shown in the accompanying illustration, is self-contained and can be moved readily from one location to another.

The machine submerges the stock; lubricates it completely on both the top and the bottom; and then efficiently removes excess lubricant. The scuff-free, hydraulic, double-gripper feed assures the exact duplication of the stroke length, making it possible to feed within 0.003 inch of the selected setting without heavy impact. The cut-off is synchronized with the feed cycle and is actuated at the completion of the forward stroke or during the return stroke of the stock-feeding grippers. Blanks of a predetermined size are cut off with a minimum waste of stock—ready for feeding directly into the press dies.

Circle Item 107 on postcard, page 225

Milling Machine with Tracer Attachment

The U. S. Burke Machine Tool Division, Cincinnati, Ohio, has available a tracer attachment designed to automatically control the knee of its vertical milling machine. This attachment is of the hydraulic Turchan Follower type, developed to simplify the machining of multiple molds, dies, and complex parts.

The tracer system controls the vertical rise and fall of the table through a hydraulic cylinder mounted in place of the regular vertical screw. Cylinder movement is controlled by a valve that is actuated by a stylus in contact with a model or template located on the machine table. The stylus, which thus governs the vertical movement of the table, is set in the same plane as the milling machine spindle.

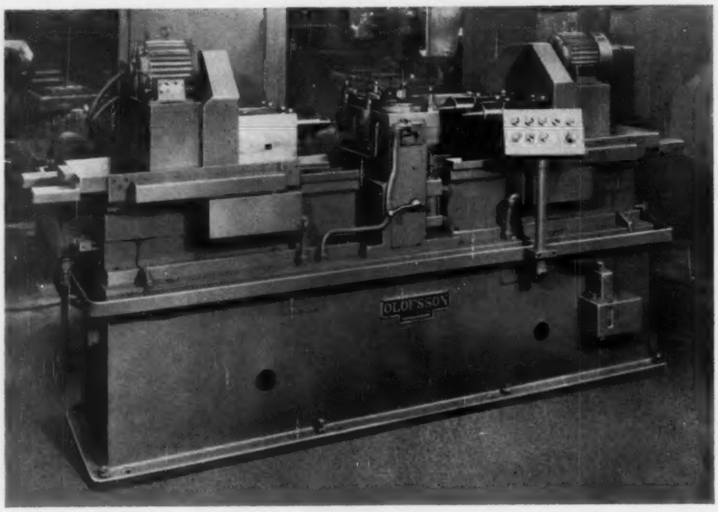
The range and capacity of the mill are in no way limited by the automatic control. Under normal machining conditions, the depth of cut can be controlled to within a tolerance of plus or minus 0.001 inch. The machine table may be manually fed or its longitudinal movement mechanically controlled by the use of the standard, variable-speed table feed of the milling machine.

Circle Item 108 on postcard, page 225

Two-Station Double-End Precision Boring Machine

A two-station, double-end precision boring machine has been developed by the Olofsson Corporation, Lansing, Mich., for use in the high-speed production of automotive parts. The machine illustrated is equipped to finish-bore two opposed, accurately aligned holes simultaneously in cast-iron differential cases. Production at 100 per cent efficiency is at the rate of 250 cases per hour. The holes are bored straight and round within 0.0005 inch.

The machine is designed for fast, easy, manual loading and unloading with the aid of an elevator device. The entire operating cycle is push-button controlled. After loading the part into the nest, the clamp-start cycle button is pressed. Both units then bore simultaneously and rapidly return to the unload position. When the units are in the clear position, the hydraulically operated finger-clamps are released automatically.



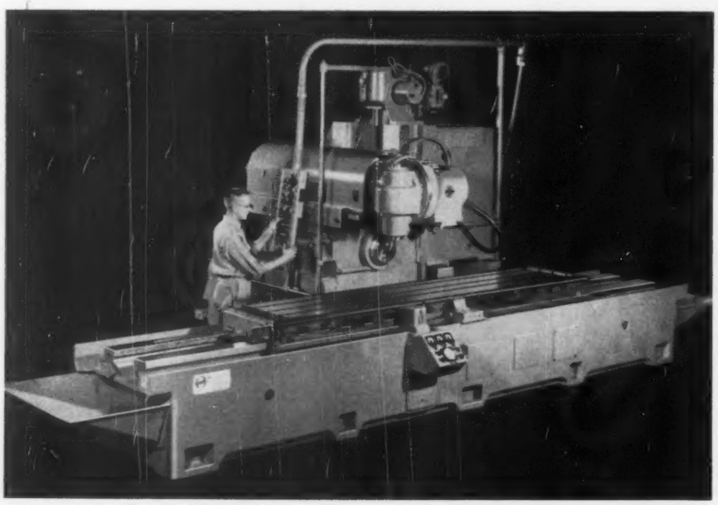
Olofsson double-end precision boring machine

A hand cycle is provided for additional retraction of spindles to facilitate setting or removal of cutting tools and for independent control of either unit. Features of the machine include rigidly ribbed nickel-iron base and center section; JIC electrical and hydraulic controls; and an automatic lubrication system.

Circle Item 109 on postcard, page 225

Sundstrand Universal Bed Type Milling Machine

The Sundstrand Machine Tool Co., Rockford, Ill., has announced the addition of a universal bed type milling machine to its line of "Rigidmils." This machine combines longitudinal feed of the table, cross-feed of the column, and vertical feed of the head. These feed motions are provided by motors that are independent of the spindle motor. The machine illustrated has a wide range of feed movements and is equipped with an all-angle ram type head. This head is adjustable through an arc of 360 degrees, both parallel and crosswise to the machine table. When not in use, the head can be retracted to clear the horizontal spindle.



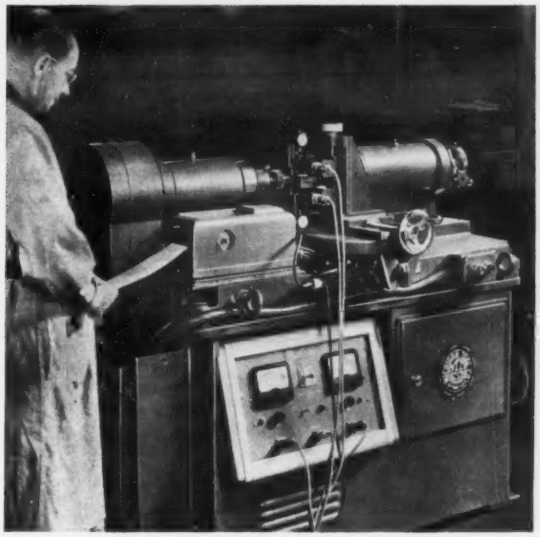
Universal bed type milling machine announced by the Sundstrand Machine Tool Co.

Twenty-four speed changes are available on both the horizontal spindle and the all-angle head in a range from 14 to 1450 R.P.M., with changes made from a selector switch on the control pendant. With the main spindle, the power range is 1 H.P. per R.P.M. up to a maximum of 50 H.P. and with the all-angle head, 1/2 H.P. per R.P.M. up to 20 H.P.

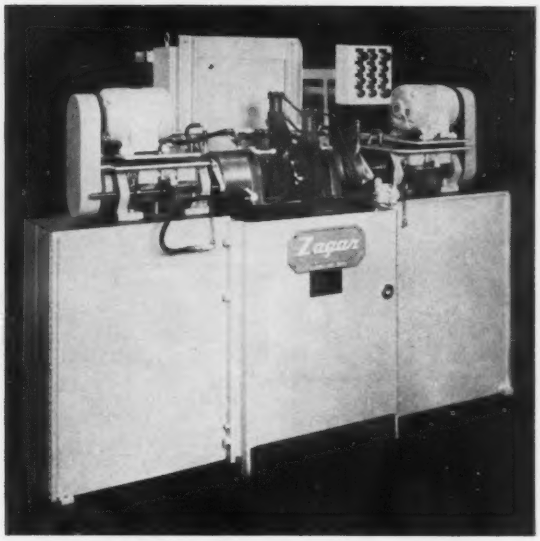
With the fixed-height bed design, the cutter is positioned to facilitate loading large workpieces and to permit easier observation of cutting operations. The bed type design also makes possible the use of a wider table and longer table feed strokes.

Feed movements are infinitely variable within the machine range, with control switches on the pendant for fast easy selection of the feed desired. The machine is equipped with vernier scales for table, column, and head positioning. It has been designed with mechanical screw feeds for application of controlled tracing and programming.

Circle Item 110 on postcard, page 225



Precision spur gear checker made by Michigan Tool Co.



Multiple-spindle heads and fixture made by Zagar, Inc.

Automatic Precision Gear Checker

An automatic precision gear checker has been developed by Michigan Tool Co., Detroit, Mich., for rapid inspection of aircraft and similar types of precision spur gears. The Model 481 illustrated checks both parallelism and tooth spacing. In addition it provides a permanent chart record. This checker can be used to inspect gears with face widths ranging from 1/4 inch to 2 3/4 inches and in a diameter range of 1/2 inch to 14 inches. Charts graduated in increments of 0.0001 inch make possible readings to closer limits.

It takes approximately five seconds to check a tooth. The inspector simply loads the gear and depresses the start-button. The rest of the cycle is fully automatic. All or any desired number or combination of teeth can be checked in any gear.

Gears are checked by fingers which move in and out of contact with the teeth. The gear is automatically indexed while the fingers are moving out of contact with the gear tooth and returning to the starting point in contact with the next tooth.

Indexing is controlled by an index-plate. Plates for gears with different numbers of teeth as well as the master index-plate provided with each machine are stored in the base of the checker.

The fingers are manually adjusted to the size of the gear being inspected. An adjustable eccentric shoe makes setting of the length of stroke a quick and simple operation. Gears are easily mounted for inspection on an internal adjustable locking arbor and driven by a roll lock chuck.

Circle Item 111 on postcard, page 225

Multiple-Spindle Heads for Drilling Variety of Hole Patterns

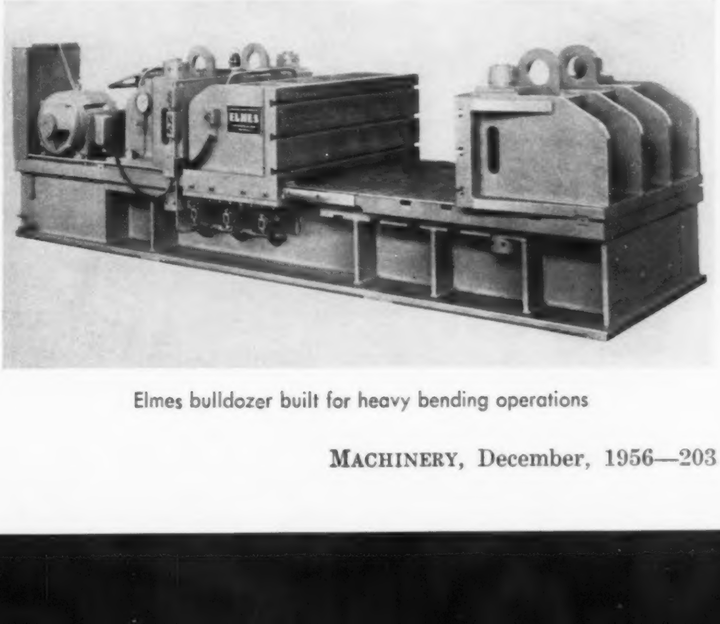
The screw holes in three revolver handles and a swing-down component are completely drilled by two multiple-spindle drill heads made by Zagar, Inc., Cleveland, Ohio. The change from one part to another is accomplished by means of specially designed fixtures in the machine shown.

Each fixture holding a revolver handle is self-contained and can be inserted in the machine quickly. The drill heads, mounted on opposed feed units on either side of the work-holding fixture, are rotated to the proper position for the specific handle being drilled. Automatic cycling, including approach, feed, and return movements, is hydraulically controlled.

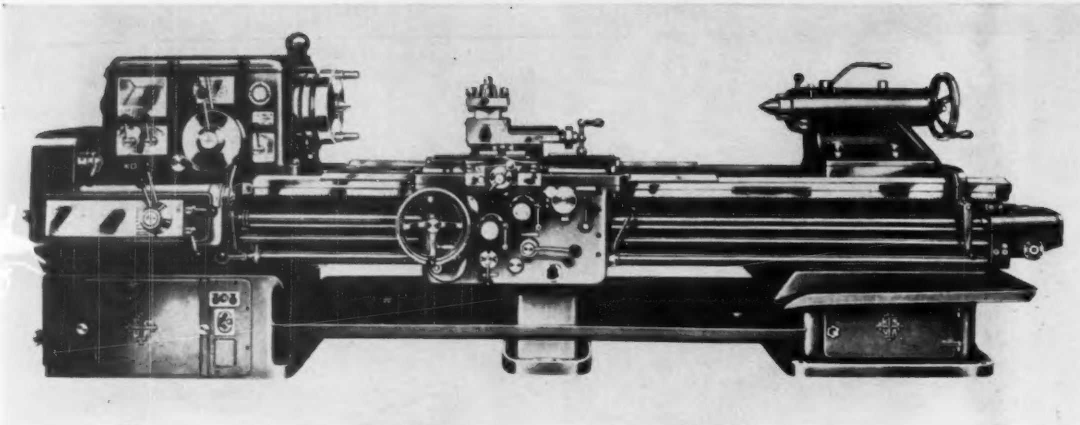
Circle Item 112 on postcard, page 225

Automatic Bulldozer for Heavy Bending Operations

A 200-ton Elmes hydraulic bulldozer with full electrical control for automatic or semi-automatic operation has been announced by



Elmes bulldozer built for heavy bending operations



Koping lathe introduced by Homestrand, Inc.

the American Steel Foundries, Elmes Engineering Division, Cincinnati, Ohio. This exceptionally large, ruggedly constructed machine is designed to speed up unusually heavy bending operations. It is completely self-contained, with both the control box shown at extreme left in the illustration and the pumping unit built integral with the machine. This permits the machine to be moved about the plant as a portable unit.

Operation, including jogging, is by foot-switch control. No presetting of the press stroke is necessary. To change jobs, the operator simply changes dies. The length of the unit is 17 feet 8 1/2 inches; the width, 6 feet; and the over-all height, 4 feet 8 inches. The opening capacity is adjustable from a maximum of 60 inches to a minimum of 12 inches. Speeds in inches per minute are: 140 for the advance, 41 for the press, and 285 for the return movements.

Circle Item 113 on postcard, page 225

Koping High-Speed Lathe

Homestrand, Inc., Larchmont, N. Y., is introducing in this country a new model Type S12A high-speed Koping lathe. This machine is manufactured by the Kopings Mekaniska Verkstads Aktiebolag, Sweden. The lathe has a maximum swing over the bed of 24 inches and eighteen spindle speeds ranging from 11.4 to 950 R.P.M. It is made in four bed lengths with between-center distances of 60, 80, 100, and 120 inches.

Extra equipment available includes taper-turning attachment; profiling attachment; quick power traverse to carriage; and a variety of chucks, tool-holders, and rests.

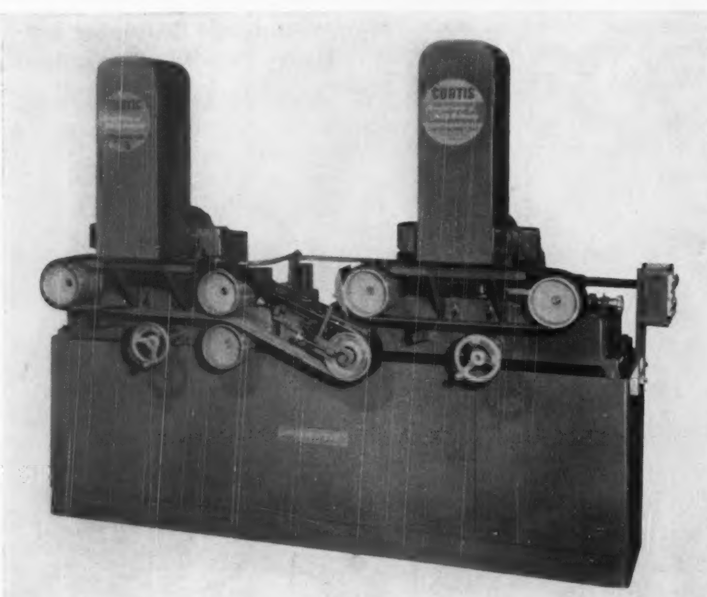
Circle Item 114 on postcard, page 225

"Straight-O-Matic" Grinding Machine

Near automation in the grinding, polishing, and deburring field is made possible by the Model 304C2 double-side "Straight-O-Matic" grinder manufactured by the Curtis Machine Corporation, Jamestown, N. Y. This machine incorporates a turn-over transfer unit between conveyorized abrasive belt heads and will grind, polish, or deburr both sides of a work-piece in one handling.

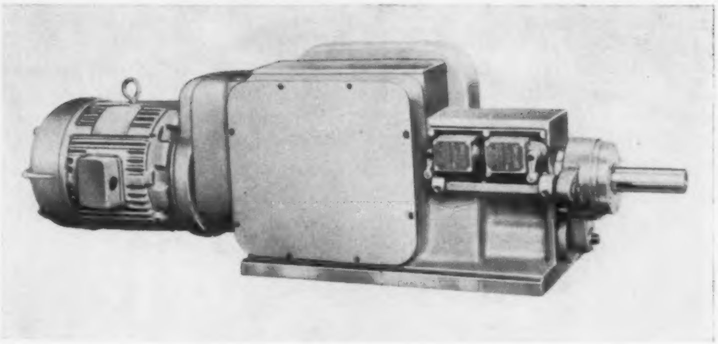
The simple, turn-over mechanism provides for grinding and polishing pieces of different sizes and shapes. The machine uses abrasive belts 4 inches wide by 54 inches long, and is equipped with a 1 1/2-H.P. motor drive for the abrasive belt and two 1/4-H.P. infinitely variable speed drives for the conveyors.

Circle Item 115 on postcard, page 225



Curtis "Straight-O-Matic" double-side grinding machine

Millholland Drilling Unit with Automatic Cam Feed



Automatic cam-feed drilling unit developed by the W. K. Millholland Machinery Co.

A drilling unit embodying many new features, including an automatic cam feed, has been added to the line of hydraulically actuated and cam-fed units manufactured by the W. K. Millholland Machinery Co., Indianapolis, Ind. The automatic plate-cam feed is designed for high operating efficiency. It provides rapid approach and return movements and has 85 per cent of the cam surface available for metal-removing feeds.

The unit is completely enclosed, has built-in counterbalance, and is lubricated by a "Micro-Fog" system. This eliminates oil seals on all rotating shafts and permits the unit to be mounted in any position and to be lubricated completely and automatically. Clutching and declutching have been simplified by the use of an air-solenoid-operated feed clutch, which gives instantaneous response in the starting and stopping cycle. The air clutch can be set to disengage at any desired feeding pressure.

A single tool may be used in the spindle, or a multiple head can be attached to the spindle-carrier. The motor drive is through gearing to the spindle and consists of an end-mounted standard NEMA-dimensioned motor of 3/4 to 5 H.P. Feed to the camshaft is through gearing mounted on the side of the unit case. Built-in limit switches insure electrical interlocking for special machine applications. Change-gears provide a wide range of speeds and feeds.

Circle Item 116 on postcard, page 225

Warner & Swasey Hydraulic Contour-Tracing Attachment

A hydraulic contour-tracing attachment for use on the 3A and 4A extra heavy duty saddle type turret lathes is announced by the Warner & Swasey Co., Cleveland, Ohio. The unit, which complements the internal contouring slide-tool previously introduced, is capable of heavy metal removal in the contour-turning and facing of both average and large-size work-pieces. It provides for precise control of successive roughing, semifinishing, and finishing cuts, using a single flat or round template as the master pattern.

Warner & Swasey extra heavy duty saddle type turret lathe equipped with contour-tracing attachment

The tracing attachment is designed for mounting on the rear of the cross-slide at an angle of 45 degrees. By pre-setting stop-screws to the desired depths of cut, as many as six successive template-controlled cutting passes can be made across the work-piece without the need for any manual cutting tool adjustments.

The single template type pattern is mounted in a bracket attached to the overhead pilot-bar. Flat templates are held in a clamp type mount, while round templates utilize a pair of simple insert type center adapters. Micrometer adjusting screws are employed to facilitate accurate alignment of the template with the spindle axis. Conversion of the tracer from contour-turning to facing operations is accomplished quickly with the installation of a special holder in the template mounting bracket.

The tracer-slide is actuated by means of a large hydraulic cylinder powered by a separate hydraulic pump unit. The cylinder, with a 6-inch stroke, provides an

effective maximum cutter travel of 4 inches. The hydraulic system is of the differential pressure type, regulated by a micro-sensitive, stylus-controlled valve. By retracting the tracer to its rearmost position, the lathe may be utilized for standard turret-lathe work.

The attachment is designed to function with the machine spindle rotating in the reverse direction to obtain maximum rigidity and accuracy and to reproduce, in a minimum of time, work with complex contours, tapers, and stepped forms up to and including 90-degree shoulders.

Circle Item 117 on postcard, page 225

Indexing Type "Burr-Blasting" Machine

Continuous deburring of finish-machined cast-iron or non-ferrous parts at rates ranging from 250 to 350 per hour can be attained with the indexing type "Burr-Blaster" for in-line installations built by Modern Industrial Engineering Co., Detroit, Mich. Actual production depends on the part and whether two or four blasting guns are used. The machine is designed for removal of "fragmentary" burrs—all those burrs not caused by upsetting of metal.

Parts either roll or slide down a track to the loading station, where they are clamped automatically by a neoprene mandrel mounted on an air cylinder. Next, the work-holding fixture is indexed, elevating the work-piece into the blasting cabinet. To insure thorough and uniform removal of all fragmentary burrs, the part is rotated continuously during the blasting operation.

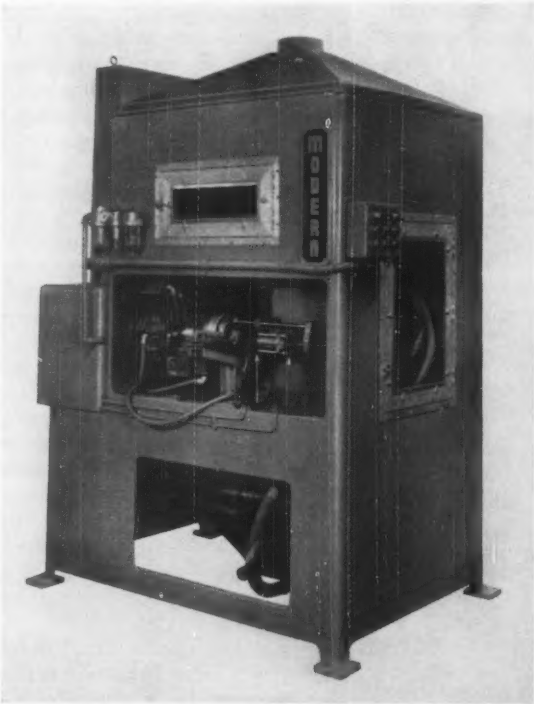
Ground-up walnut shells and peach pits, silicon carbide, aluminum oxide, steel shot, and grit can be used with equal efficiency by the in-line indexing machines. Correct blasting material for a specific job is selected by the manufacturer. At the completion of the "Burr-Blasting" operation, the part-holding fixture is indexed to the unloading station, where the work-piece is stripped from the fixture and allowed to slide or roll down the exit chute to the conveyor leading to the succeeding operation. Either manual or automatic loading and unloading can be employed. When loading and unloading are performed automatically, no operator is required. Air consumption per gun is 26 cubic feet per minute at a pressure of 70 pounds per square inch.

Circle Item 118 on postcard, page 225

Optical Comparator with Long-Range Measuring Stage

Opto-Metric Tools, Inc., New York City, is introducing a Wilder "Micro-Projector" with a long-range measuring stage. The stage reads to 0.0005 inch by means of 1-inch, heavy-duty micrometer heads and has a capacity of 1 1/2 by 4 inches, the additional range being obtained by gage-blocks.

The longer capacity range permits measuring pieces up to 4 inches long at one time without relocating the work-piece. This not only speeds up the measuring operation but eliminates the possi-



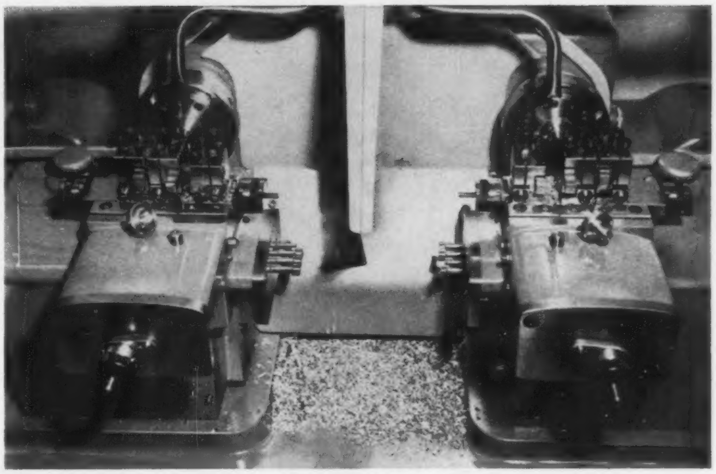
"Burr-Blaster" for removing "fragmentary" burrs built by Modern Industrial Engineering Co.

Wilder "Micro-Projector" of increased range introduced by Opto-Metric Tools, Inc.

bility of errors which may occur in manually moving the piece.

The Wilder "Micro-Projector" embodies features of preceding models, including a horizontal work stage with vertical light beam, a full range of magnifications, and a full complement of accessories.

Circle Item 119 on postcard, page 225



Kummer lathe for secondary operations

Cam-Controlled Two-Spindle Lathe

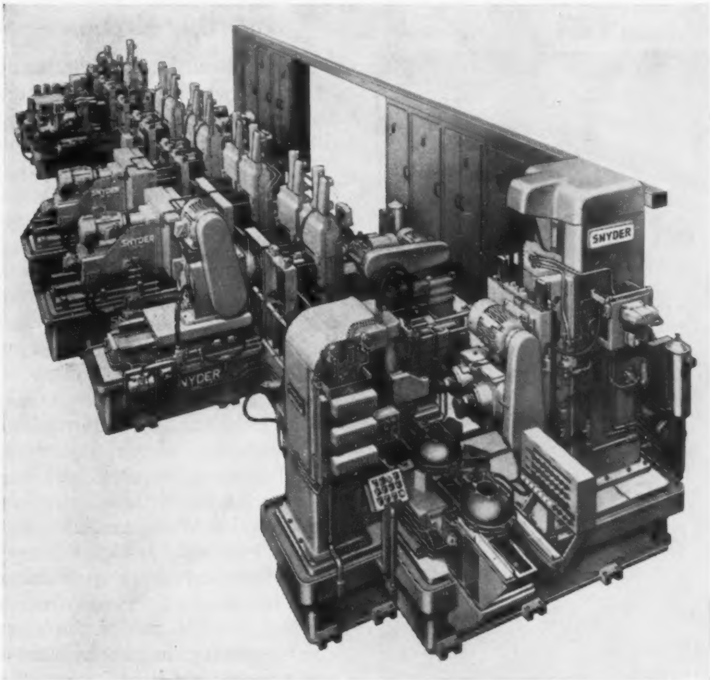
Carl Hirschmann Co., Inc., Manhasset, N. Y., is introducing a Kummer lathe for secondary operations. The machine has two spindles, working independently of each other. Parts can be processed in one spindle and then advanced to the other, or different parts can be processed simultaneously. One operator tends both spindles, loading or unloading one while the other is cutting.

Each spindle has a separate carriage and slide on which cutters are mounted. A cam, designed for each application, feeds the carriage and slide coordinately to the work. Both are then retracted by spring pressure. Curved surfaces can be cut without the need of forming tools. Spindle speeds are infinitely variable up to 3500 R.P.M. The pedal-actuated collet chuck has a capacity of 2 1/2 inches.

Circle Item 120 on postcard, page 225

Transfer Machine for Processing Converter Housings

A twenty-four-station, segmented, in-line transfer machine, 55 feet long, has been built by Snyder Tool & Engineering Co., Detroit, Mich., for processing converter housings. This hydraulically operated, electrically controlled machine mills three target pads on the side of the cast-iron converter housing while employing critical clearance surfaces on the inside of the part. The part is then tipped up and located on the milled pads, where it remains throughout the transfer, on rails, from one machining station to the succeeding one.



Segmented, in-line transfer machine built by Snyder Tool & Engineering Co. for processing converter housings

With this arrangement, no pallets are required in handling the hollow, spherical-shaped automotive transmission converter housings. An automation device tips the part up after the target pad milling operation is completed. Other operations include four-spindle precision boring, automatic precision air gage inspection, and automatic probing of all holes to be tapped. The machine is made up of nine individual segments, each having its own electrical control panel and individual base.

The converter housing is loaded face down on the transfer rails in the first station from which it is transferred to the second station, where the three target pads are

Besly-Welles tandem grinder for processing valve springs

milled on one face. Then it is transferred to the fourth station, where it is tipped up on the target pads. The part remains in this position throughout the balance of the boring, drilling, counterboring, chamfering, reaming, and tapping operations performed in the succeeding stations. Production is at the rate of 128 converter housings per hour.

Circle Item 121 on postcard, page 225

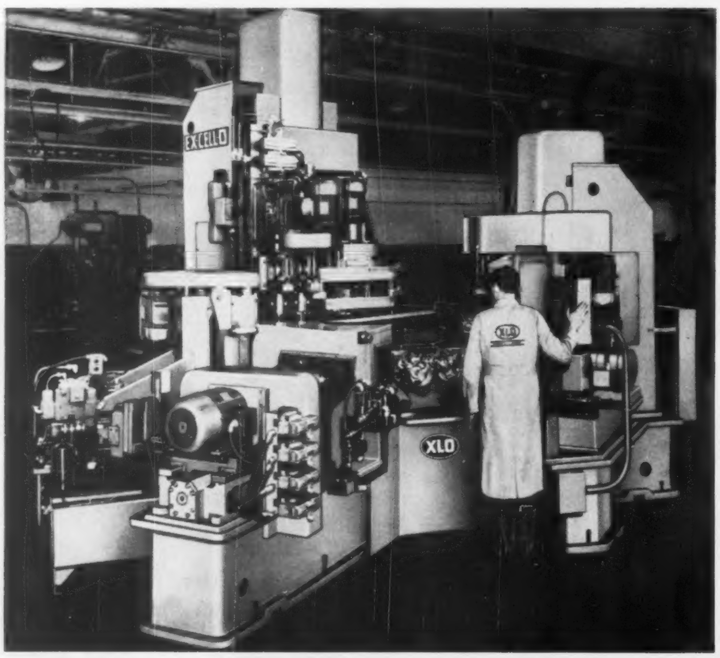
Tandem Special Grinder for Processing Valve Springs

Industrial springs in sizes from 1 inch to 2 1/2 inches in diameter and from 1 inch to 3 inches long can be ground flat on the ends at exceptional production speeds on a tandem special grinder brought out by the Besly-Welles Corporation, South Beloit, Ill.

The machine illustrated is set up to grind the ends of tractor valve springs 2 1/2 inches long made of wire 0.187 inch in diameter. These springs are fed to the hopper from a chute and placed in holders on the feed-wheel of the grinder by the operator. Alterations in the feed-wheel design can be made to accommodate different work-pieces. Two pairs of grinding discs, diametrically opposed and with separate power drives, are incorporated in the machine. A feed-wheel moves pieces to be ground between each pair of discs in one revolution. Thus the machine rough- and finish-grinds in one controlled operation. The first pair of heads carry roughing discs for removing metal, while the second pair grind the ends of the springs to the required finish and tolerance specifications.

The springs are automatically unloaded into boxes through an opening at the end of one complete revolution of the feed-wheel. Roller conveyors carry full boxes of ground springs on to the next operation which consists of shot-peening.

Circle Item 122 on postcard, page 225



Ex-Cell-O eight-station rotary indexing machine

Eight-Station Rotary Indexing Machine

An eight-station rotary indexing machine which performs more than twenty operations on air conditioner compressor crankcases was built recently by the Ex-Cell-O Corporation, Detroit, Mich. Operations include rough-boring, counterboring, facing, spot-facing, drilling, chamfering, back-chamfering, and tapping. The machining cycle is entirely automatic, including clamping and unclamping.

The die-cast aluminum crankcases handled on this machine have cast-iron cylinder liners and are of three different kinds, having one, two, and three cylinders, respectively. While periodic output for each kind is high, change-overs from one kind to another must frequently be made according to market demands. An average net production rate of eighty-seven pieces per hour is normally maintained.

Circle Item 123 on postcard, page 225

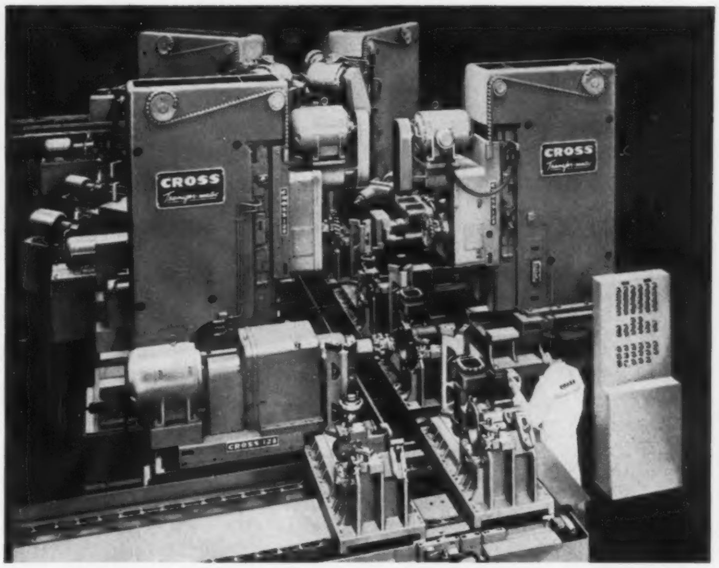
Transfer-matic Equipped to Process Air-Conditioning Housings

Complete machining of air-conditioning housings from rough castings to assembly is accomplished on a Transfer-matic built by The Cross Company, Detroit, Mich. This machine produces eighteen pieces per hour at 100 per cent efficiency. It performs 159 operations, including six milling, six boring, one facing, eighty-one drilling, and sixty-five tapping.

Two-position, progressive type, palletized fixtures carry the workpieces from station to station. Building-block type construction facilitates servicing and replacement of machine parts. This feature also simplifies the problem of changing machine setups to suit modifications in product design. All parts of the machine, even tooling details, are made to tolerances that assure interchangeability.

Other features of the Transfer-matic include construction to JIC standards; hardened and ground ways; hydraulic feed and rapid traverse for milling, drilling, and boring; individual lead-screw feed for tapping; automatic lubrication; and automatic chip conveying.

Circle Item 124 on postcard, page 225

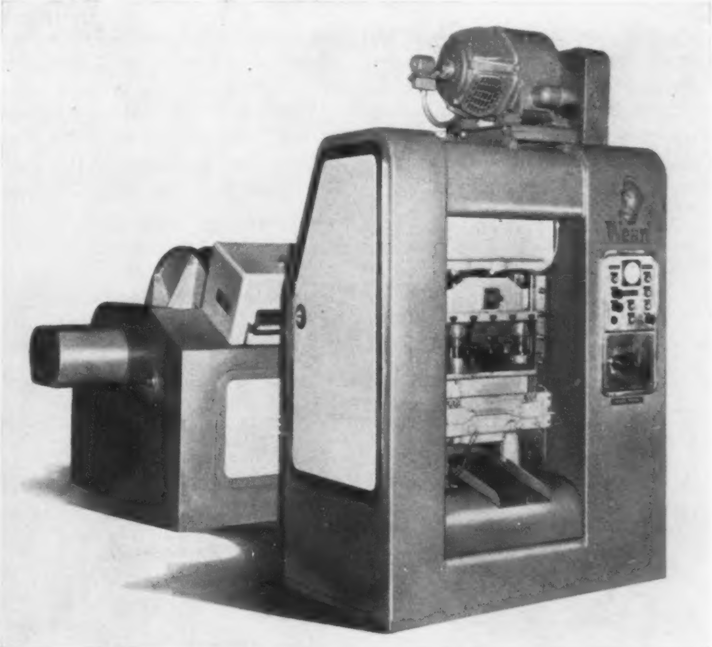


Transfer-matic for processing air-conditioning housings

Wean Flying Press with Continuous Stock Feed

A flying press having movable upper and lower platens which synchronize with the forward motion of the strip during operation has been brought out by the Wean Equipment Corporation, Cleveland, Ohio. A set of feed-rolls geared to operate in synchronization with the motion of the dies permits the stock to be fed continuously. The length of the indexing movement is infinitely adjustable within the given range of the machine, which is balanced so that it operates with practically no vibration. The bottom die can be lowered out of engagement with the upper die in a controlled sequence of operations. The press has neither clutch nor brake. Bearings are lubricated by a pressurized oil system.

The decoiler unit, developed especially for use with this press, is supported on two narrow face cones incorporated in large-diameter discs which act as side guides for the coil. These discs are supported on two rollers and are brought into contact with the coil by a handwheel. A lift, which can be raised or lowered by a motor-operated jack, centers the coil on the cones. A leveler consisting of a set of entry pinch-rolls and four work-rolls is incorporated in the decoiler for removal of coil set. This leveler is driven by a motor and feeds the strip into a loop before it enters the press.



Flying press with continuous stock feed brought out by the Wean Equipment Corporation

The flying presses are being built in 40-, 60-, 100-, 125,- 150-, and 200-ton capacities. Maximum coil-width capacities range from 14 to 36 inches. Driving motors for these presses range from 20 to 50 H.P.

Circle Item 125 on postcard, page 225

Sheldon Lathes with Heavy-Duty Variable-Speed Drives

The Sheldon Machine Co., Inc., Chicago, Ill., has announced a series of 11- and 13-inch swing lathes featuring heavy-duty, variable-speed drives. These lathes permit stepless selection of speeds from 40 to 1800 R.P.M. Speed changes are made instantly by raising or lowering a T-handle speed-selector lever. Actual spindle speeds are read on the large tachometer dial built into the headstock. Only nine seconds is required to change from low to high speeds in either direct or back-gear drive. The spindle speed range is 200 to 1800 R.P.M. in direct drive and 40 to 300 R.P.M. in the back-gear drive.

The operator raises or lowers the selector handle (depending on whether he wants a higher or lower speed) and releases the handle when the tachometer dial indicates desired spindle speed. For certain production jobs, stops can easily be set for automatic selection of two predetermined speeds.

Ample power is assured at all speeds by the over-size, heavy-duty drive unit which takes a 2-H.P., three-phase motor. Double V-belts are used throughout the drive from the motor to the spindle. Other features include "Zero Precision" tapered roller spindle bearings, a 54 pitch gear-box, and a friction disc clutch for engaging power longitudinal and power cross feeds.

A complete range of toolroom and production accessories is available for these lathes, including flame-hardened bedways, taper key drive spindle noses, bed turrets, and air attachments. The lathes can be had in a variety of bed lengths with center distances of 26, 36, and 48 inches.

Circle Item 126 on postcard, page 225

Milling and Centering Machine

The Motch & Merryweather Machinery Co., Machinery Mfg. Division, Cleveland, Ohio, has introduced a small compact transfer machine designed to perform double end-milling and center-drilling operations. This machine is built to operate on the in-line transfer principle. Opposed milling heads and drill heads are mounted on ways at either side of a fixture table.

Work is loaded into the fixture at the front of the machine. The fixture then traverses to the milling position at the rear of the bed, where the milling heads advance from each side, perform the milling operations, and retract. The table then moves forward to the center-drilling station, where the two opposed drilling heads advance, drill, and retract. The operator unloads the machined part and reloads the fixture with a new part.

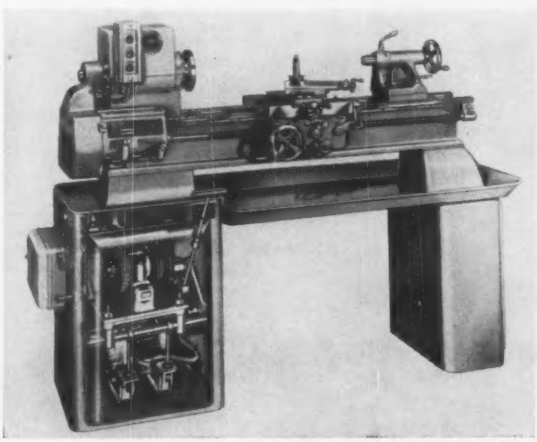
The fixture has hydraulically actuated work-holding clamps. The cycle is completely automatic from loading of the part through the unclamping of the finished piece.

Circle Item 127 on postcard, page 225

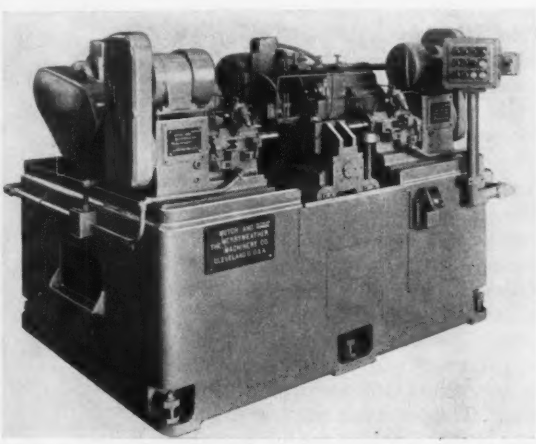
Clearing Rotary Cam Limit Switch

The Clearing Machine Corporation, Division of U. S. Industries, Inc., Chicago, Ill., has introduced an automation limit switch of the rotary cam type especially designed for timing material handling and other auxiliary functions necessary for automatic press operation. The increased use of iron hands, stock unloaders, die lifters, dopers, and other automatically controlled devices in conjunction with Clearing presses has created the need for this timing and controlling mechanism which can be set to micrometer accuracy. Extremely fine timing is possible with this switch equipment which permits hairline adjustments to be made through a full 30-degree cycle.

The limit switch is placed

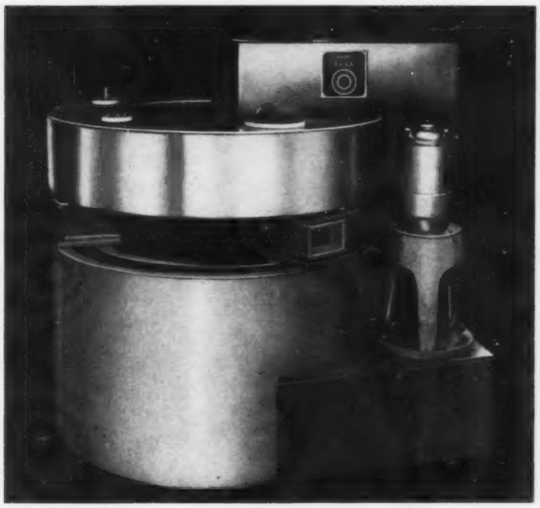


Sheldon lathe equipped with variable-speed drive



Motch & Merryweather milling and centering machine

Clearing automation limit switch with control relays



Lindberg heat-treating furnace using induction heating

within a dust-tight, oil-free compartment built into the press frame to prevent mechanical damage and to keep working parts in clean, continuously workable condition. Heavy-duty power take-off mechanisms are provided to assure accurate synchronization with the press motion. The switch is furnished in three sizes, having four, nine, and eleven cams. Proper switch selection is based on the number of automatic functions to be used in conjunction with the press. Working parts are made of bronze or cadmium-plated steel. The camshaft has sealed ball bearings, and the switch requires no lubrication.

Circle Item 128 on postcard, page 225

Heat-Treating Furnace Using Induction Heating

A heat-treating furnace, called the "Induct-O-Ring," has been brought out by the Lindberg Engineering Co., Chicago, Ill. This furnace is designed to employ induction heating for carbonitriding, bright-hardening, and carburizing of small parts--eliminating heating elements, element terminals, burners, and gas or electric connections in the furnace proper. Although induction heating has been used in Lindberg melting furnaces for several years, this is the first heat-treating furnace in which it has been incorporated.

Another feature is the circular shape of the "Induct-O-Ring" which prevents heat and atmosphere losses caused by opening doors to charge and remove the work load. A material saving in floor space also results from the use of the circular-shaped induction ring heater. Other advantages claimed for this furnace include over-all high heating efficiency, exceptionally fast heating rate, and accurate, precise temperature control with practically no temperature override or lag when the control point is reached and the power goes off and on.

Operation of the furnace is automatic and extremely simple. It has a reciprocating motion and turns slowly in the direction of work travel, then quickly reverses. With each reversal action, the work remains in the forward position and regularly progresses through the chamber until it reaches a discharge chute.

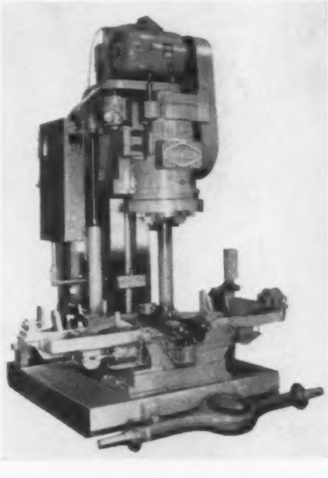
Circle Item 129 on postcard, page 225

Baker Machine for Facing Rear-Axle Housings

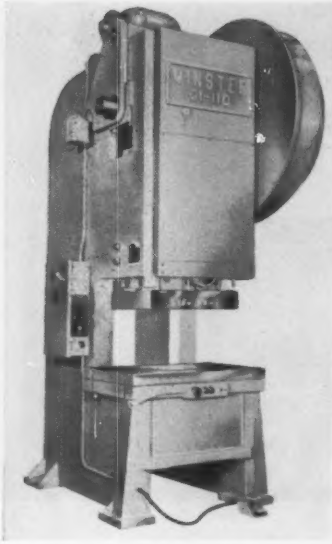
A basic machine that makes an even cut across the face of a rear-axle housing has been built by Baker Brothers, Inc., Toledo, Ohio. The work-piece is loaded into the machine by a hydraulic clamping fixture which grips the two ends of the housing. Next, a gage on the fixture swings out over the center of the housing to locate the center. Then, a jack raises the center of the housing to the gage. Before the facing operation begins, the gage swings out of the way. Production is at the rate of 34.2 housings per hour at 100 per cent efficiency. The fixture handles four different size housings. Tooling consists of a standard Baker cross-feed facing head.

The machine can be adapted for boring, drilling, and tapping simply by changing heads, and it can be easily retooled for changes in product or production methods.

Circle Item 130 on postcard, page 225



Baker basic machine equipped for facing rear-axle housings



Minster fixed-base gap press

Minster Fixed-Base, Single-Point Gap Press

A 110-ton capacity press of the fixed-base type is being introduced by the Minster Machine Co., Minster, Ohio. This is an addition to the company's Series G1 single-point gap press line made of fabricated steel "C" frame construction. The design is said to assure minimum deflection under capacity loading. Unusually long press gibs and bronze-lined ways on the cast slide maintain accurate slide-to-bed parallelism. The slide area is 21 inches front to back by 28 inches left to right, and the bed area is 27 by 42 inches. Slide adjustment is of the barrel type and may be operated manually or by air power.

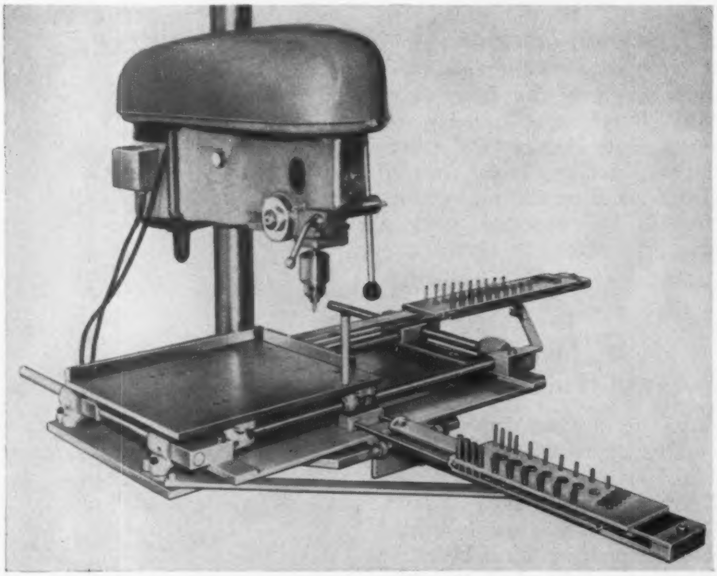
The press illustrated is a single-geared type and operates at a speed of thirty-seven strokes per minute. The company's combination air friction clutch and brake unit is mounted on the crankshaft within the main drive gear. The drive gear itself turns on anti-friction bearings, is totally enclosed, and runs in oil.

Circle Item 131 on postcard, page 225

Drill Press Positioner

Bayer Industries, Phoenix, Ariz., have developed a table attachment for drill presses that rapidly positions work for drilling. The device can be adjusted through a coordinate movement by means of pin settings. Work can be spot-drilled, then placed on another machine for the actual drilling. Or, if drills are short and tolerances ample, the device can be used for actual drilling and the spot-drilling operation can be eliminated. No laying out or prick punching of the holes is needed.

Circle Item 132 on postcard, page 225



Bayer Industries coordinate attachment for drill presses

Niagara notching and punching press

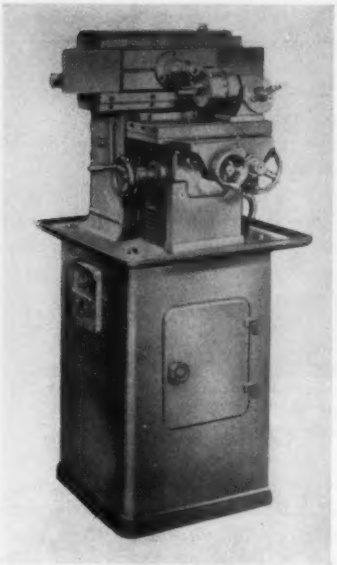
Notching and Punching Machine

An air power notching and punching machine designed to speed up operations in sheet-metal shops and metalworking plants has been introduced by Niagara Machine & Tool Works, Buffalo, N. Y. This versatile machine has a capacity of 6 1/2 tons, throat depth of 4 3/4 inches, and is furnished with a large variety of punches and dies for producing simple or intricate holes, trimming corners, or performing a combination of trimming and cut-off operations.

A foot-operated valve frees both hands for locating and feeding the material. The ram can be lowered gradually to locate work at prick-punched points and to facilitate die changing. The throat permits notching and punching well inside the edge of the sheet. A special duplex setup with two machines mounted on a single stand for edge or corner notching facilitates the fabrication of drums, pails, pans, and similar objects. A single foot-operated valve controls both machines simultaneously.

Other optional equipment includes floor stand; feed table with adjustable squaring edge especially adapted for handling large sheets; and a wide variety of punching attachments.

Circle Item 133 on postcard, page 225



Contour and punch shaping machine

Jemco Contour and Punch Shaping Machine

The Jersey Mfg. Co., Elizabeth, N. J., has announced a Jemco K-150 form and punch shaper designed to produce high-precision, close-tolerance punches with curved necks. Punches are said to need no further machining operations when completed on this machine. All work-pieces are clamped directly in a collet holder between centers or to the coordinate chuck. The coordinate chuck and indexing attachment guide the work-piece along the contour with one chucking, thus eliminating re-chucking errors.

All machining operations can be checked in the shaping process with the special built-in 30-power microscope. This microscope, which is used in the manufacture of extremely high precision punches for instruments, clocks, and watches, serves also as an accurate measuring device.

Circle Item 134 on postcard, page 225

High-Speed Automatic Stamping Press

Alpha Press & Machine, Inc., Detroit, Mich., has brought out a high-speed, automatic stamping press. This 75-ton, double-crank, direct-drive production machine is built for precision work and will handle long, unbalanced, progressive dies without distortion.

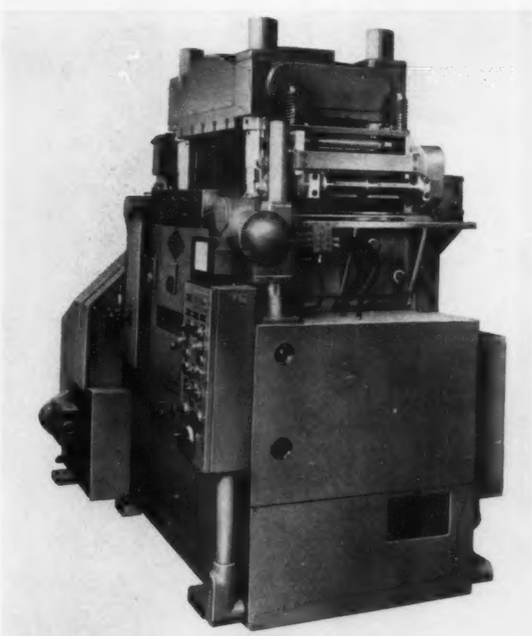
The press is 7 feet 5 inches high and requires a floor space of 68 by 95 inches. The standard stroke is 2 inches; the maximum stroke is 4 inches; and the rated speed of this 75-ton press is 150 strokes per minute.

The feed mechanism is of the roll type and is designed as an integral part of the press. It is connected to the crankshaft by a moving rack arranged to eliminate lost motion. The roll feed will handle metal up to 13 1/2 inches in width and up to 3/16 inch in thickness. Force-feed lubrication contributes to the quiet operation of the press.

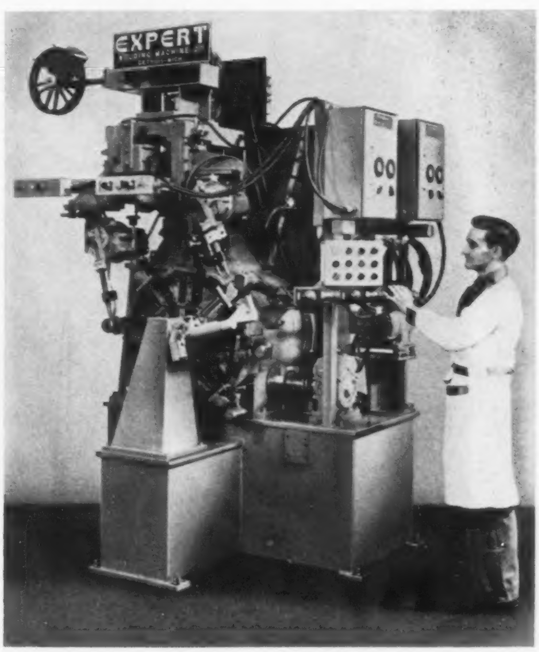
Circle Item 135 on postcard, page 225

Automated Eight-Station Welding Machine

An automated, eight-station, trunnion, indexing type arc-welding machine which features a cam-index mechanism and a simple cam-clamping mechanism is available from the Expert Welding Machine Co., Detroit, Mich. The machine illustrated employs the CO_2 shielded-arc welding method to join an outer cup and support bracket at the rate of 433 assemblies per hour at 80 per cent efficiency. The two pieces joined by this welding operation form an



Double-crank, high-speed, automatic stamping press announced by Alpha Press & Machine, Inc.



Eight-station, trunnion, indexing arc-welding machine brought out by the Expert Welding Machine Co.

automotive motor mount. By changing the clamping fixture, the machine can be adapted to a variety of two-piece parts which require joining with longitudinal welds. The basic design of this welder is adaptable to submerged-arc or argon shielded-arc welding.

The welding machine is 8 feet high and occupies a floor space of about 4 by 5 feet. Power for the cam drive is supplied by a 1 1/2-H.P. electric motor. Welding current is furnished by two 600-ampere rectifiers.

Circle Item 136 on postcard, page 225

Federal Giant-Size Spot-Welding Machine

A three-phase, frequency converter spot-welder—said to be the largest resistance spot-welding machine of this type ever built—has been announced by the Federal Machine & Welder Co., Warren, Ohio. This machine is over 13 feet high and weighs more than 58,000 pounds. It is designed with a special throat or work-clearance area of approximately 2100 square inches to accommodate a portion of the tail section of the largest commercial jet airliner under construction in this country.

The Federal three-phase, unipolar transformer which supplies the 100,000-ampere welding current is also the largest of this type ever constructed. It weighs over 25,000 pounds and required entirely new construction techniques.

Circle Item 137 on postcard, page 225

Huge Hydraulic Plastics Molding Press

A huge hydraulic plastics molding press, manufactured for the General American Transportation Corporation by the Verson Allsteel Press Co., Chicago, Ill., has a bed and platen area of 100 by 192 inches. It is big enough to hold an automobile, with room to spare, as shown in the illustration. The total weight of the press is 400,000 pounds.

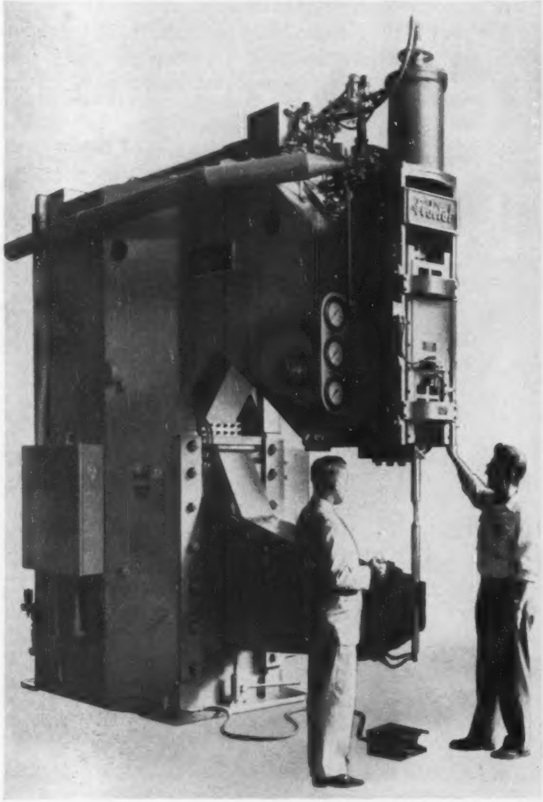
This molding press is of the four-housing type with preshrunk tie-rods. Square gibs provide eight bearing surfaces for ram travel during press operation.

The press will be used for reinforced plastics work. It is fully adjustable to allow for expansion and contraction during hot-forming operations. This feature will enable molded parts to be held to close tolerances.

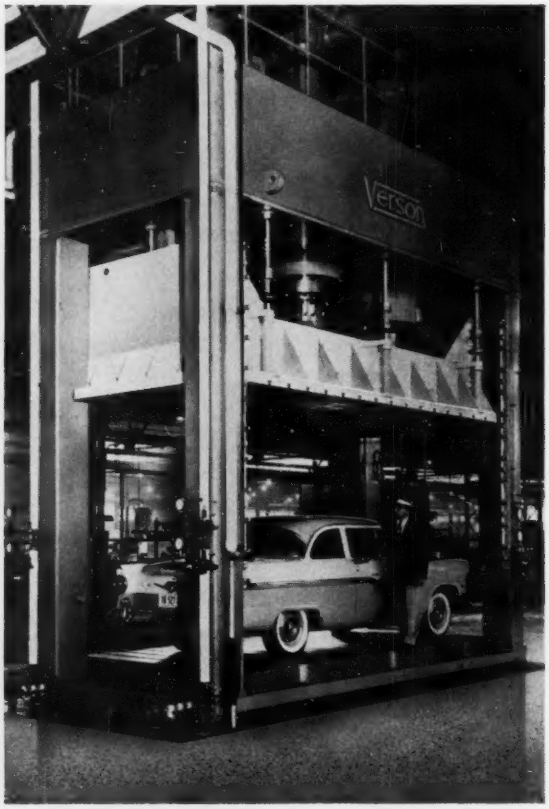
Circle Item 138 on postcard, page 225

Continuous Abrasive Belt Unit

A 6-72 continuous abrasive belt unit manufactured by the Grinding & Polishing Machinery Corporation, Indianapolis, Ind., can be used either as a suspended tool or mounted on its own stand. It can also be employed as an attachment or part of another machine such as a metal lathe, for instance. A large variety of acces-

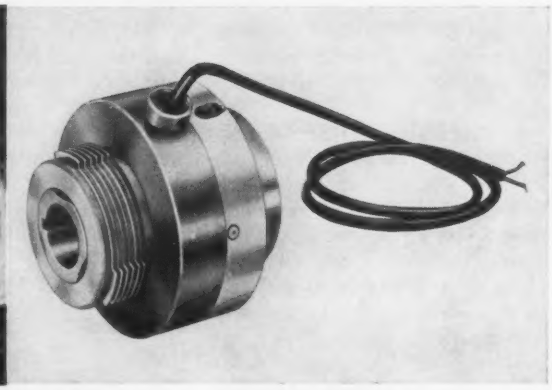


Federal giant-size spot-welding machine



Verson hydraulic plastics molding press

Continuous abrasive belt unit manufactured by the Grinding & Polishing Machinery Corporation



Electric floating-disc clutch announced by the Carlyle Johnson Machine Co.

sories adapt it to a multiplicity of uses in metalworking shops.

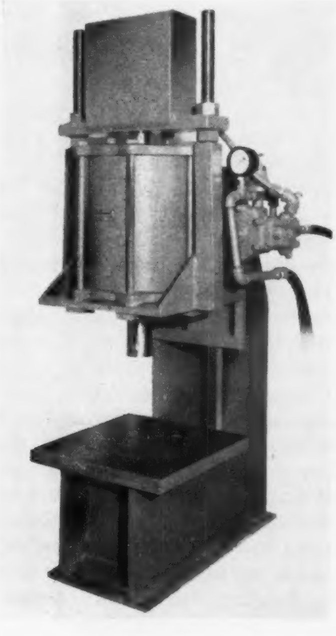
Circle Item 139 on postcard, page 225

"Vi-Speed" Air-Operated Arbor Presses

A line of heavy-duty, air-operated "Vi-Speed" arbor presses is now available from the Van Products Co., Erie, Pa. The line includes sixteen models with capacities ranging from 1 to 5 tons. They have up to 6 3/4-inch throat clearance with adjustable ram clearance up to 12 inches. Any stroke is available from the minimum of 2 inches to the maximum ram clearance.

These presses can be used for cutting gates from castings and for riveting, forming, bending, press-fitting, and similar operations. Units up to 2 tons have rams with outside diameters of 1 1/2 inches. Larger units have rams 2 inches in diameter. Most rams are keyed for nonrotation. The presses are either hand- or foot-controlled.

Circle Item 140 on postcard, page 225



"Vi-Speed" arbor press

Hydraulic Marking Machine

The Parker Stamp Works, Hartford, Conn., has announced a No. 710 hydraulic marking machine which occupies a floor space of 18 by 20 inches—yet performs marking operations requiring up to 8000 pounds pressure, with a maximum lettering length of 3 1/2 inches. It will stamp up to four lines of 1/16-inch characters. The heavy die slide operates on roller bearings.

Simplified controls; recessed switch well with indicator light; and quick, simple adjustment of table and die-slide stroke make this machine well suited for general marking operations. It accepts flats up to 5 inches thick and rounds up to 5 inches in diameter, and handwheel adjustment will move the table 4 inches up or down. A single convenient control knob quickly adjusts the pressure. Production capacity is 800 to 1000 parts per hour.

Circle Item 141 on postcard, page 225

Maxitorq Electric Clutches

Maxitorq electric floating-disc clutches, available in a full range of standard sizes, both single and double types, have been announced by the Carlyle Johnson Machine Co., Manchester, Conn. The clutch consists essentially of a sealed magnetic coil enclosed in the clutch housing and acting through a sleeve and pressure-plate to compress the clutch discs. An important design feature is that the electromagnetic actuating mechanism is stationary. Positive pressure is exerted and maintained on the clutch discs entirely by

Parker hydraulic marking machine

means of the magnetic flux—there is no mechanical contact between the moving and the stationary parts.

Another feature is that the magnetic flux and, in consequence, the pressure exerted on the clutch discs can be precisely controlled by varying the voltage. The clutch, therefore, can be used where it is desirable to pick up or slow down a load gradually from a remote station. Other applications of this equipment include its use as a "dead man" type of control in conjunction with the safety devices regularly provided.

Maxitorq clutches can be furnished with either steel discs (usually running in oil) or with standard bronze-faced discs for dry applications. All sizes operate on 110-volt alternating current, rectified to 90-volt direct current, and have a consumption rating of approximately 80 watts.

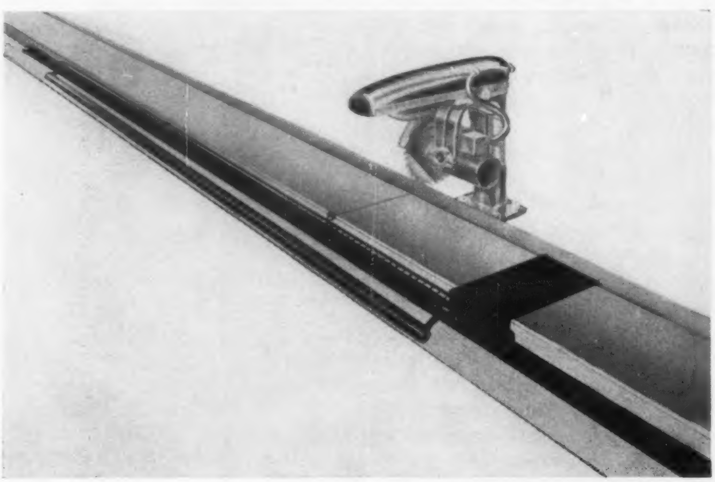
Circle Item 142 on postcard, page 225

Snow Cut-Off Gage

A cut-off gage of entirely new design has been developed by the Snow Mfg. Co., Alhambra, Calif., to speed up production and eliminate errors wherever cut-off equipment is used. This gage, designated M6, can be easily installed on any size table from 8 to 18 inches wide and will not interfere with existing setups. It will measure accurately and quickly any length from 1/2 inch to 9 feet, and is adaptable for accurate cuts at any angle.

The gage is locked in position by raising or lowering the operating bar without requiring the operator to move from his position in front of the cutting device.

Circle Item 143 on postcard, page 225



Cut-off machine equipped with gage introduced by Snow Mfg. Co.

Fig. 1. Impact wrench brought out by the Black & Decker Mfg. Co.

Black & Decker Impact Wrench and Power-Speed Controlled Screwdriver

An impact wrench and a power and speed controlled screwdriver have been brought out by the Black & Decker Mfg. Co., Towson, Md. Designed for cool running, durability, and speed while delivering a steady output of power, the new impact wrench, Fig. 1, will deliver 1800 high-intensity impacts per minute and cannot be stalled or overloaded. Its power output is identical for operation either in forward or reverse, and it reaches its maximum torque in six seconds. A specially designed centrifugal fan and ventilating system keep this tool at the coolest possible operating temperature at all times.

Fig. 2. Operation of "Scrugun" can be varied by means of a Power-Speed control unit

In addition to the nut-running and lag-screwing operations which the tool was designed for, many accessories can be attached with the aid of adapters. Drill bits ranging from 3/16 to 1/2 inch in diameter can be driven, as well as hole saws, masonry bits, and thread taps.

With the company's Power-Speed control unit coupled to a "Scrugun," or screwdriver, an infinite number of instantaneous adjustments are possible to drive screws far smaller than those for which the tool was designed. This control unit, Fig. 2, is especially valuable in precision industries where fragile screws can now be production-driven without injury to delicate materials such as ceramic, plastic, and glass.

As an example, the No. 8 "Scrugun" independently drives No. 8 screws. When combined with the Power-Speed control, adjustments of finger lightness can be set by dial, and screws down to a No. 0 size can be driven. These adjustments can be duplicated any time by resetting the dial in the same position.

Circle Item 144 on postcard, page 225

"Unipunch" unit made by Punch Products Corporation

"Unipunch" Hole-Punching Units

A new line of "Unipunch," Series "G," hole-punching units has been announced by the Punch Products Corporation, Niagara Falls, N. Y. These units are completely self-contained, with no parts attached to the press ram. The punch and die are held in accurate alignment by a rugged Meehanite holder adapted for close center-to-center hole locations in angles, channels, extrusions, and strips, as well as sheets. A special slot in bottom of holder fits "Unipunch" press brake bed rail, permitting setups for gang punching to be easily and quickly made. The punching units have a shut height of 7 1/2 inches and die height of 3 1/8 inches for punching holes up to 0.3125 inch in diameter in mild steel up to 1/8 inch thick on minimum center-to-center distances of 3/4 inch. The throat depth of holder is 3 inches.

Circle Item 145 on postcard, page 225

Air Pressure Hydraulic Valve

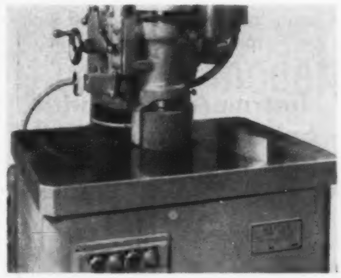
A hydraulic four-way valve, air pressure-operated by an air pilot valve, is being offered by Rivett, Inc., Boston, Mass. The air pressure feature of the hydraulic valve permits using it automatically when the air pilot valve is controlled mechanically. An example of such an application is its use in an automatic reciprocating circuit for the controlled feed of a machine table. (See accompanying diagram.) The cycle is started by shifting manual control valve *2*, allowing oil from power unit *1* to pass through air pressure pilot-operated valve *3* to blind end of cylinder *4*, causing the piston to move forward. As the cam of flow-control valve *6* is depressed, the required rate of speed of forward stroke is obtained. When pilot valve 5 is contacted, the pilot pressure shifts pilot-operated control valve *3* and cylinder travel is reversed, and the cycle is repeated automatically. To stop table, manual control valve *2* is shifted to original position and oil is by-passed to tank.

Circle Item 146 on postcard, page 225

Profiler and Contour Grinder

A heavy-duty master profiler and contour grinder featuring ample power, large capacity, and easy adjustment has been announced by the Kindt-Collins Co., Cleveland, Ohio. This machine is especially designed for fast removal of metal on steel punch or heavy press die sections in tool and die shops.

Wheels, including the cup type, range in size up to 6 inches in diameter by 4 inches high. Power is supplied by a completely enclosed 2-H.P. motor, remote-controlled by push-buttons and mounted on the over-arm at the top of the spindle housing. The grinding wheel can be used with an oscillating stroke of 3/8 inch at the rate of 72 oscillations per minute at the option of the operator. The separate oscillating motor is also controlled by a remote push-button. The wheel can

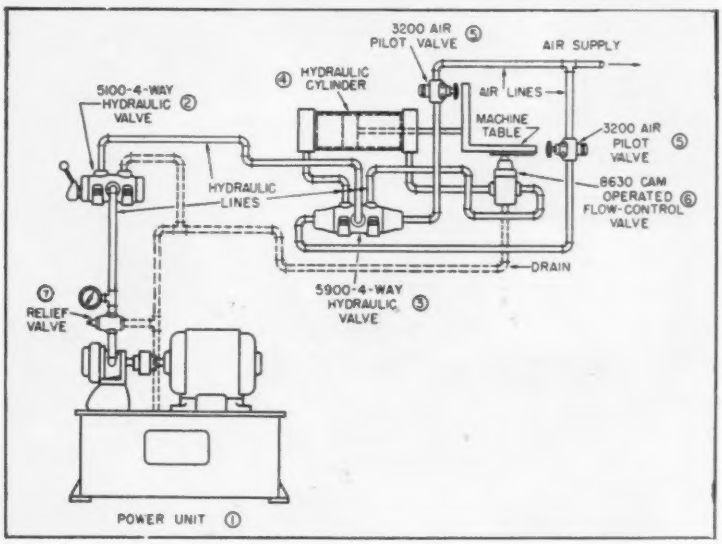


Kindt-Collins profiler and contour-grinding machine

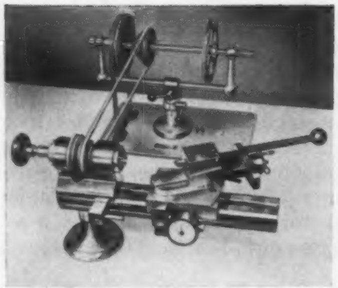
be tilted from 0 to 5 degrees and raised 10 inches above the table.

Fast, accurate dressing of the wheel is accomplished by a diamond dresser which is an integral part of the machine. The profiler and contour grinder may be connected to either a dust-collecting system or separate unit. Over-all dimensions of the machine are 32 inches wide, 37 inches deep, and 76 inches high. Net weight is about 1500 pounds.

Circle Item 147 on postcard, page 225



Application of Rivett valve to control a machine table



Levin instrument lathe fitted with spherical turning rest

Instrument Lathe with Spherical Turning Rest

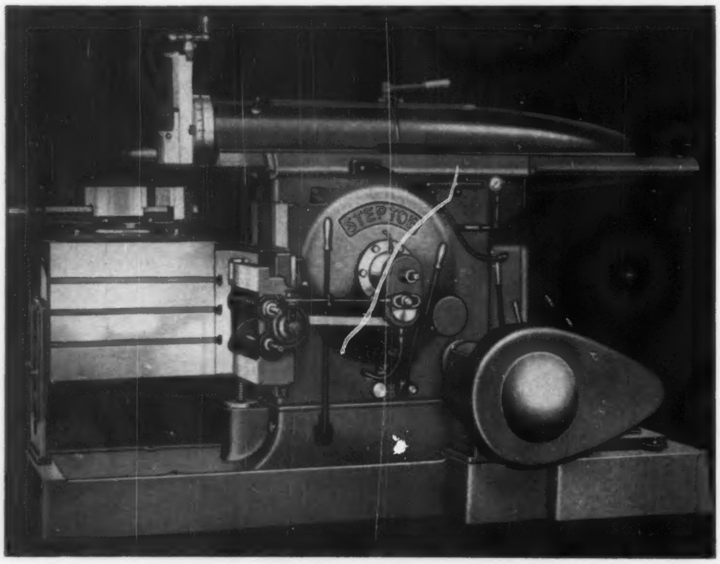
Louis Levin & Son, Inc., Los Angeles, Calif., has equipped some of its instrument lathes with spherical turning rests for use in the production of Tuohy corneal lenses at the Solex Laboratories. These tiny, high-precision lenses average twenty-hundredths of a millimeter in thickness and weigh less than one-fiftieth of a gram when finished. The spherical turning rest has a vertical adjustment for centering the cutter and can generate either a convex or concave surface up to 1/2-inch radius within limits of 0.01 inch.

The lenses are made from dime-size discs stamped from a sheet of Lucite. These discs are mounted in a step collet and fitted into the Levin instrument lathe. The inside, or concave surface, of the lens is then cut to fit the curvature of the cornea. Reversed and remounted on an arbor, the outside, or convex surface, of the lens is then cut to the required optical prescription. The finish produced by these cutting operations is fine enough to permit the lenses to be polished after turning without requiring intermediate operations. The spherical turning rest can be applied to any model Levin instrument lathe.

Circle Item 148 on postcard, page 225

Steptoe Heavy-Duty Shapers

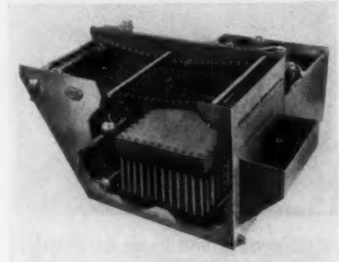
The Western Machine Tool Works, Holland, Mich., have announced a heavy-duty Steptoe shaper built in 14-, 16-, 20-, and 24-inch sizes. All drive-shafts, and the bull gear, are mounted on Timken bearings within dustproof housings, and can be supplied with an automatic forced-feed lubricating system. All gears within the speed-box are of alloy steel, generated on gear shapers, and chamfered where required for easy sliding engagement. Four speed changes within the speed-box, combined with sliding back gears within the column, produce eight ram speeds in progression. All speed changes may be made while the machine is running.



Steptoe heavy-duty shaper announced by Western Machine Tool Works

Steptoe-Western high-speed medium-duty type shapers are also available in 12- and 15-inch sizes. These shapers can be furnished with four, nine, or eighteen speeds up to 200 strokes per minute.

Circle Item 149 on postcard, page 225



Delpark filter announced by the Industrial Filtration Co.

Delpark Screen Type Filter

A Delpark "Filter-Matic" tubular screen type filter, made in flow capacities of 5 to 1000 gallons per minute, has been announced by the Industrial Filtration Co., Lebanon, Ind. This filter is designed for efficient handling of coolants, cutting oils, and all liquids requiring removal of minute particles. An outstanding feature of this machine is the small floor space requirement.

The sludge-laden liquid is drawn through a suction header composed of small-diameter screen tubes by a special multiple-chamber valve and is pumped into a filtered liquid compartment. A system of automatically reversed and controlled liquid flow removes the sludge from the screen tubes, causing it to drop to the bottom of the filter compartment, where it is removed by chain-driven dragout flights.

Circle Item 150 on postcard, page 225

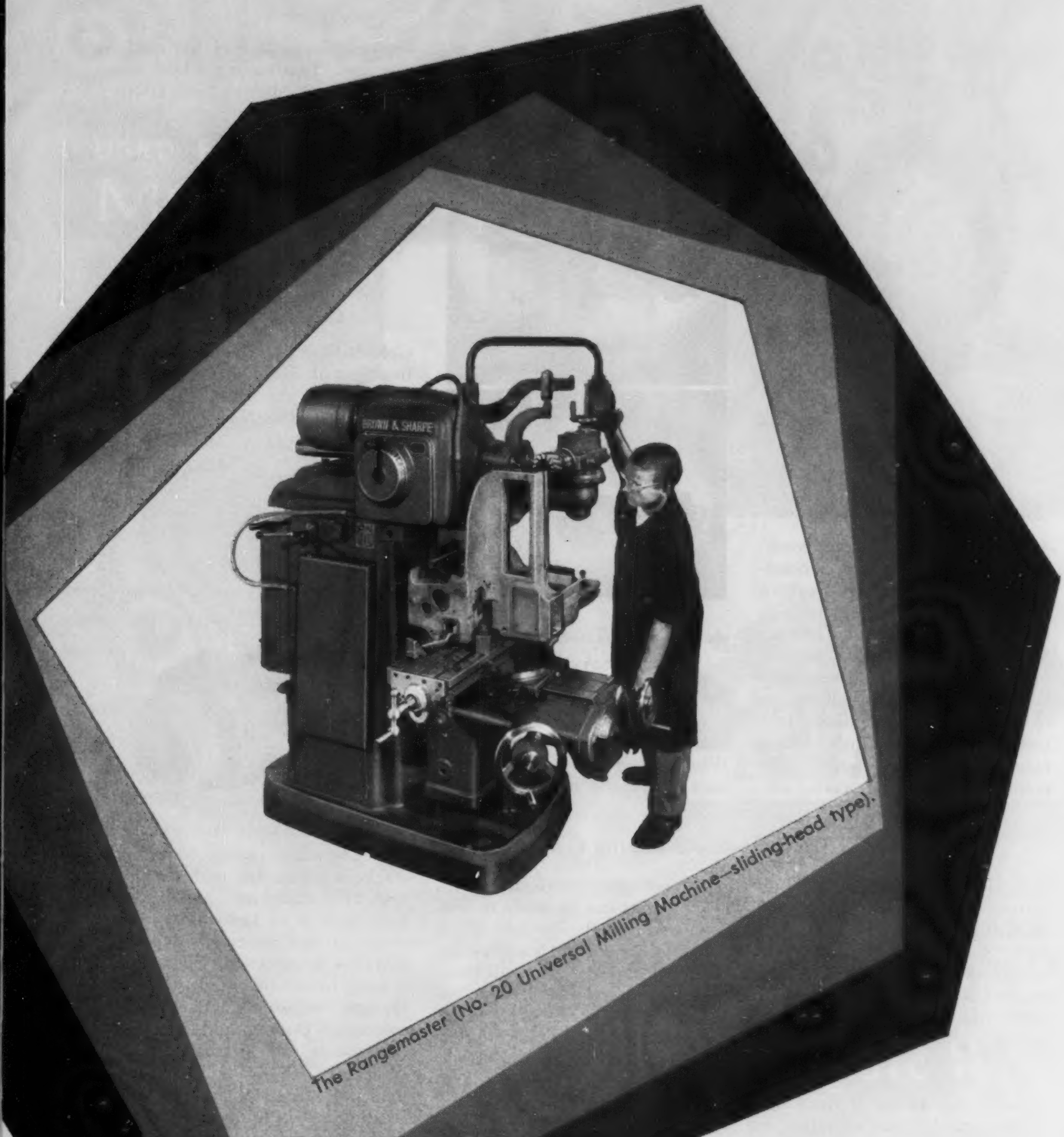
Iron Powder Electrode

The Metal & Thermit Corporation, New York City, has announced an improved iron powder electrode of the AWS E-6010 classification, designated "Murex Speedex R." This electrode is said to be especially suitable for welds on machinery parts and many low-alloy, high-tensile steels up to 1/4 inch thick.

Circle Item 151 on postcard, page 225

(Continued on page 222)


CINCINNATI
BICKFORD



The Rangemaster (No. 20 Universal Milling Machine—sliding-head type).

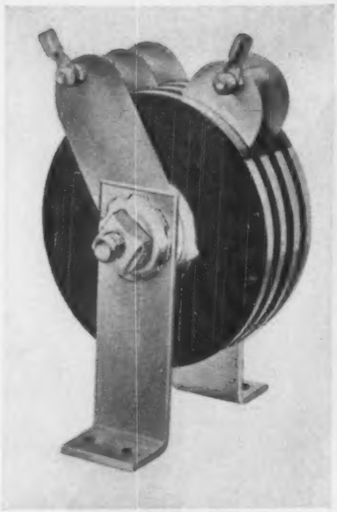
Horizontal, vertical, or angular milling quickly available with full 3 h.p. at spindle.

Universal head permanently mounted on crane—swings completely out of way when not in use. Both spindles always at ideal height for fast set-up and easy operation.

Full use of table travel plus exceptional sliding head range permits milling of many multi-surface jobs with only one work set-up.

BS

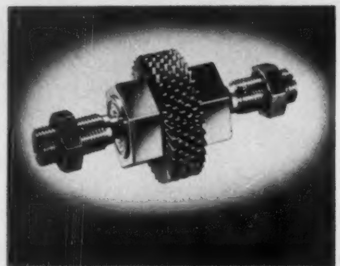
Brown & Sharpe

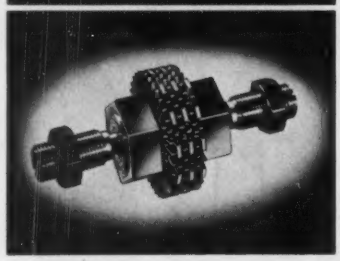


Electrical Circuit Resistor

A new Thyrite discharge "varistor" assembly—the first commercial offering of a voltage-sensitive nonlinear resistor of its type—is announced by General Electric's Metallurgical Products Department, Detroit, Mich. It is suitably mounted for direct installation in electrical circuits. The device protects motors, generators, lifting magnets, magnetic chucks, solenoids, relays, large coils, etc. against high inductive surges resulting from sudden interruption of inductive currents.

Circle Item 152 on postcard, page 225





Abrasive-Disc Dresser-Cutter Assembly

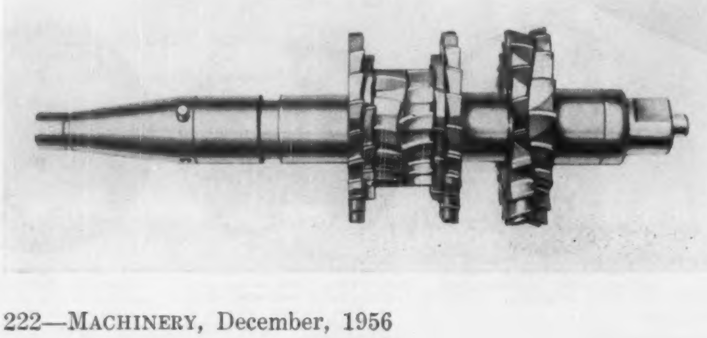
Besly-Welles Corporation, South Beloit, Ill., has available an advanced functional design Type A Wise dresser-cutter assembly. It lasts longer and picks, instead of crushes, the surface of the abrasive disc. Two cutting wheel assemblies (as shown) are interchangeable on the same basic arbor, giving this dresser broad application for both soft and hard discs. Cutters are mounted on a square arbor, and the assembly rotates on sealed ball bearings.

Circle Item 154 on postcard, page 225

Aber Curved-Tooth Multiple Milling Cutters

Curved-tooth multiple milling cutters of line introduced by the Aber Engineering Works, Waterford, Wis. These units are designed for production milling and combine a wide range of standard cutters developed for taking fast, accurate cuts on any number of surfaces simultaneously. Side-milling, slotting, straddle-milling, or any combination of these can be performed in one operation. If the range of standard cutters does not meet specific requirements, special units can be made to suit. The curved-tooth principle, which provides an efficient shearing action, is incorporated on all these multiple cutters. This design eliminates corner contact of cutter with the work and is said to permit more accurate control of limits and finishes, faster heat dissipation with extended tool life, and elimination of chatter.

Circle Item 153 on postcard, page 225



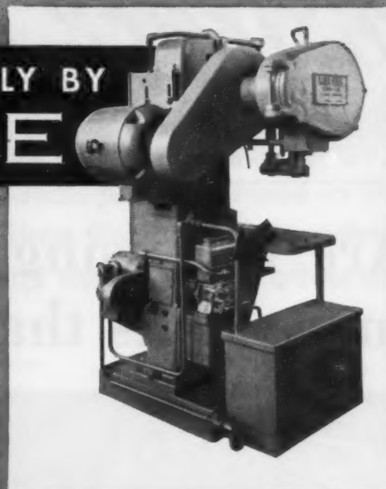
Namco Push-Button Control Switch

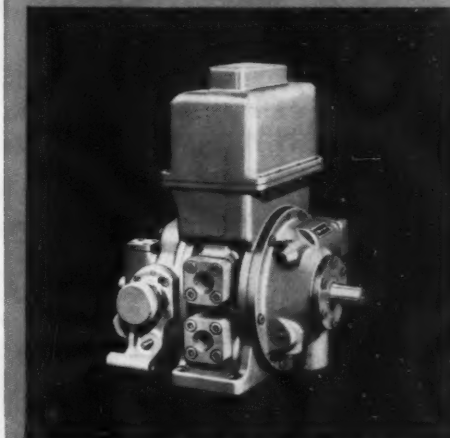
Gold-N-Ring Sealtight push-button control switch has been announced by the Electrical Mfg. Division of the National Acme Co., Cleveland, Ohio. Rated at 600 volts alternating or direct current, this dust-, oil-, and water-tight unit is of heavy-duty construction and meets all JIC and NMTBA specifications. The switch is built to mount in 1 13/64-inch diameter holes on standard panel mounting centers and will accommodate panel thicknesses of from 1/16 to 1/4 inch in increments of 1/32 inch. Switches can be obtained in flush-plate or box type mountings to permit any combination of different push-button, selector, or pilot-light assemblies. Buttons are available in an assortment of colors to conform with standard codes. Other features include plastic shields to completely enclose the silver-alloy contacts, a unit-molded main contact block to assure alignment and simplify assembly, a fully guided plunger of cross-head design to prevent binding, and an

(Continued on page 230)

OILGEAR "JK" FEED PUMPS

USED EXTENSIVELY BY MOLINE



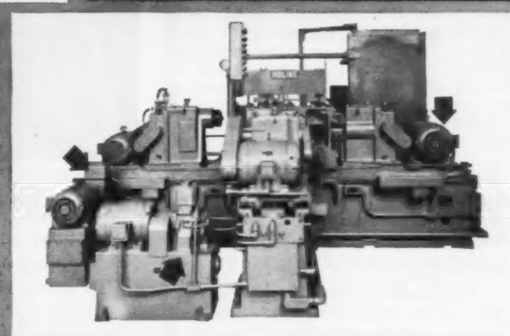


The Moline Tool Company, long established and respected in industry, has used Oilgear Fluid Power Feeds since 1925. Of Oilgear "JK" Fluid Power Feed Pumps used in its machines, Moline says these pumps *combine* the advantages found only in part in various mechanical feeds. Also, the "JK" Feed Pump provides infinitely, steplessly variable speeds; you can easily find the speed best suited to the work or condition of tools. Traverse speed can be as much as 265 times the feed rate. Coarse and fine feed rates are variable over a 20 : 1 range. Cycle time is cut drastically, production increased, costs reduced. Feed rates are maintained accurately despite varying work pressures by a built-in automatic pressure compensator.

"JK" Feed Pumps are simple, compact, electro-hydraulically controlled units, easily installed nearby or remotely. Systems need only a pump with reservoir, a double-acting cylinder, standard control and two easily connected pipes. Eliminating expensive engineering, these units can simplify design, reduce manufacturing cost, improve performance and increase saleability of machines. Manual, semi-automatic or full automatic operation. Available now in 4 sizes. Write for free literature.

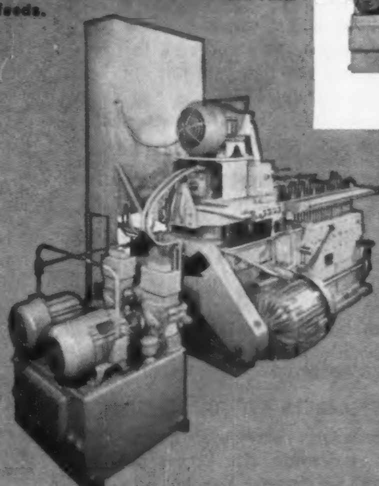
THE OILGEAR COMPANY
1569 West Pierce Street
Milwaukee 4, Wis.

Above, Moline Drilling Machine employing "JK" Feed Pump.

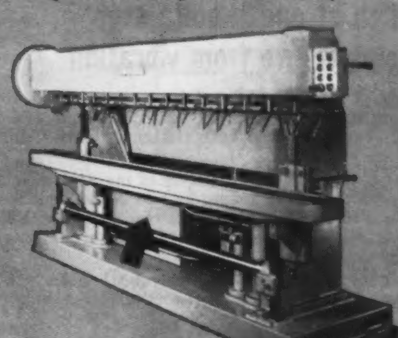


Moline 4-way horizontal boring machine uses 4 Oilgear "JK" Feed Pumps.

Below, Moline special 56-spindle back-spotfacing machine using 2 "JK" units for vertical and horizontal feeds.



Below, Moline ten-foot, straight-line drilling machine using "JK" Feed Pump.



"JK" PUMPS EASILY APPLICABLE TO YOUR MACHINES FOR BETTER PERFORMANCE

JIC

PIONEERS . . . NOW THREE PLANTS FOR FLUID POWER

OILGEAR
Fluid Power

PUMPS, MOTORS, TRANSMISSIONS, CYLINDERS AND VALVES

RB&W FASTENER BRIEFS

RUSSELL, BURDSALL & WARD BOLT AND NUT COMPANY

Technical-ities

By John S. Davey

Bolts take greatest stress during wrenching

If a bolt doesn't fail when being wrenched up tight, it won't fail in service (assuming bolts and joint have been designed adequately for the loads).

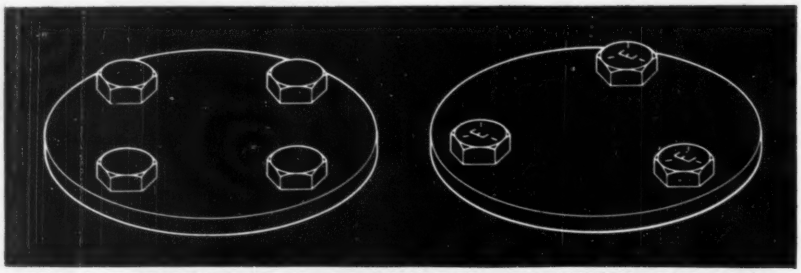
That's because two forces put stress on bolts (and cap screws) as they tighten: Tension due to bolt stretch; torsion due to friction. But only tension remains after wrenching. In a rigid joint, if this tension exceeds external forces, bolts will never experience any further strain, and will therefore not loosen or fail.

WHY SOME FAILURES?

Obviously, unusual unforeseen loads cause trouble. The instant they exceed residual tension, *they add* to the stress placed on the bolt and can cause *immediate* failure. Or they can cause loosening, leading to stress change, which in turn causes fatigue and failure. That's why you've got to torque bolts tight . . . and the tighter the better.

An exception: A flexible joint. With high cyclic loading, again loosening and fatigue cause trouble. Since you shouldn't tighten such a joint too much, sometimes the only remedy is to take out the flexible element and put in a rigid joint. (A metal to metal flange connection instead of a gasketed one, for example.)

Are you using more bolts than needed?



The stability of a 4 bolt arrangement can be matched by a 120° spacing of 3 bolts. Strength can be actually increased by using RB&W high carbon heat treated bolts (identified by "E" and three radial dashes).

NOBODY wants to use too few bolts or cap screws and risk failures. But using too many is not the best answer either. It means too many holes to drill, to fill – both costly.

RB&W offers some suggestions.

BALANCED BOLT PATTERN

By "rule of thumb," bolts are generally arranged symmetrically in a pattern of four. Yet three bolts 120° apart around a common center will prove just as stable, and save on assembly. With stability assured, the problem is then one of load capacity.

PRELOAD TO GET FULL CAPACITY

In checking size and number of bolts, calculate the stress and get rid of the excess. You have enough if you've allowed for usual factor of safety . . . *and the fasteners are tightened so that residual tension exceeds maximum external load anticipated.* If they are, you have safety. The bolts will *stay* tight, won't fatigue, won't fail.

With RB&W standard fasteners, engineers and production men can take quality, uniformity and dependability for granted – and can concentrate on the problem of proper application and assembly. For help or information on your specific product, write Russell, Burdsall & Ward Bolt and Nut Company, Port Chester, N.Y.

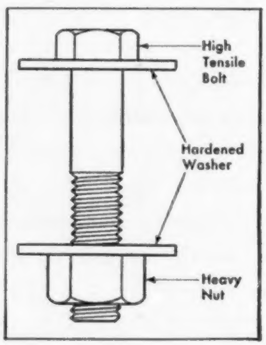
Plants at: Port Chester, N. Y.; Coraopolis, Pa.; Rock Falls, Ill.; Los Angeles, Calif. Additional sales offices at: Ardmore (Phila.), Pa.; Pittsburgh; Detroit; Chicago; Dallas; San Francisco.

High strength bolts stop joint failure from vibration

Shakeout equipment used by one company for unloading coal cars applied its vibration via a fabricated frame lowered onto the cars. This frame was originally riveted.

But it was a constant source of maintenance. About every 10 days, the frame had to be welded, loosened rivets replaced. Finally it was refastened with RB&W high tensile bolts and hardened washers. Maintenance now is *nil!*

Proving again that high strength bolts make the strongest connection for the severest service.



For more information fill in page number on Inquiry Card, on page 225

PRODUCT INFORMATION SERVICE

Use postage-free Business Reply Cards for further information
On New Catalogues described in this issue of MACHINERY
On New Shop Equipment described in the editorial pages
On products shown in the advertisements

NEW CATALOGUES

GRAY IRON CASTINGS—Gray Iron Founders' Society, Inc., 930 National City-East Sixth Bldg., Cleveland, Ohio. Buyers' Guide and Directory presenting reliable sources for gray iron castings in every industrial area. The 80-page manual contains a list of foundry sources for various types of gray iron castings. Foundries are also listed geographically. The main directory section contains data for each member foundry on type and size of castings produced, average monthly production, types of iron produced, special facilities, and executive personnel. Single copies will be sent to qualified persons submitting requests on company letterheads to the above address.

OVERHEAD CONVEYORS—Mechanical Handling Systems, Inc., 4600 Nancy Ave., Detroit 12, Mich. Ring-bound catalogue providing an easy-to-use manual on the company's Monoveyor handling systems. Copies of this catalogue are available by writing on company letterhead direct to the above address.

MINIATURE SHIELDED THERMOCOUPLES—Thermo Electric Co., Inc., Saddle Brook, N. J. Bulletin illustrating and describing the company's miniature shielded thermocouples. These small, lightweight units have a wide application in the temperature measurement of gases and vapor mixtures of gases and liquids. Included is complete information on the uses of these thermocouples. An easy-to-use chart permits selection by type number of a thermocouple of the exact specifications needed. 1

V-BELT DRIVES—Maurey Mfg. Corporation, Chicago, Ill. 66-page catalogue describing the company's V-belt drives. Catalogue is divided into three general sections—the first is devoted to drive service factors, instructions on how to select a stock drive, and complete V-belt drive tables for A, B, C, D, and E section V-belts. The general information section provides further data and facts on these drives and the drive generator section lists service factors and provides instructions and data. 2

PRESS APPLICATIONS—Fawick Airflex Division, Fawick Corporation, Cleveland, Ohio. Bulletin ML-172, describing the company's complete line of package applications for modernization of presses and similar machinery with pneumatic clutch and brake. The bulletin contains data on how to select the proper application for a press, complete dimensions and flywheel inertia information in table form, and photographs of a typical press equipped with the company's standardized press application. 3

FLUID DRIVES—American Blower Corporation, Detroit, Mich. Bulletin 9119, covering the company's Gýrol fluid drives for 1/2- to 25-H.P. applications. The fluid drive principle is fully explained. Typical performance curves compare starting torque, starting current, and heat-generator characteristics of a general-purpose alternating-current motor directly connected to a load with those of a similar motor utilizing Gýrol fluid drive. 4

HIGH-VACUUM PUMPS—F. J. Stokes Corporation, Philadelphia, Pa. 28-page catalogue entitled "Stokes Microvac Pumps for High Vacuum," containing information useful to engineers confronted with vacuum processing problems. Also contained is information on the complete line of the company's pumps, tables of formulas, constants, and conversion factors frequently used in vacuum processing. 5

INDUCTION HEATING—Magnethermic Corporation, Youngstown, Ohio. 8-page bulletin describing the induction heating equipment available from the company. Engineering data and illustrations on both low- and high-frequency equipment are given. Also included are charts on depth of hardness, low-frequency range, high-frequency range, and frequency selection chart for steel bar stock. 6

PRESS BRAKE DIES—Cyril Bath Co., Solon, Ohio. 48-page, wire-bound catalogue illustrating and describing the dies most commonly used. Dies are grouped for quick reference, primarily by the type of bend involved. Included are special-purpose dies, ordering information, and easy-to-use tables. Supplementary information is given on sheet strip, and plate gages, and weights. 7

CASTING DESIGN—Meehanite Metal Corporation, New Rochelle, N. Y. 64-page manual providing usable working data for casting designs. Discussed are the form of design; the method of making the pattern; molding procedure; the characteristics and behavior of the metal in the mold; and other elements involved in the production of sound, dependable engineering castings. 8

CONTROL VALVES—Conoflow Corporation, Philadelphia, Pa. Bulletin LB-2, giving details on construction and operating characteristics of Series LB control valves, available in sizes 1 inch through 4 inches. This series incorporates the company's single-seated, split valve body design with the cylinder Coromotor actuator. Complete specifications and valve sizing data are given. 9

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New York, N. Y.

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DRILL PRESSES—Delta Power Tool Division, Rockwell Mfg. Co., Pittsburgh, Pa. Bulletin giving description and specifications of the company's 20-inch drill press. The bulletin describes the heavy-duty construction, large capacity, and special features that make it suitable for mass production. Twenty-eight models are listed, and speeds, feeds, and capacities are given. **10**

HEAT EXCHANGERS—Young Radiator Co., Racine, Wis. Catalogue 1156, describing the company's line of removable heat exchangers Types R and RW. Catalogue contains all necessary design, capacity, and dimension data required for complete selection and specification of hydraulic equipment, Diesel engines, gas engines, compressors, transformers, and others. **11**

CRANKSHAFT GRINDING WHEELS—Simonds Abrasive Co., Philadelphia, Pa. Catalogue giving information on the company's crankshaft grinding wheels for production use in automotive type engine plants. Special information is included for multiple-spindle setups for grinding main or line bearings. Additional data is given for single-wheel setups for pin bearings. **12**

AIR POWER NOTCHER AND PUNCH—Niagara Machine & Tool Works, Buffalo, N. Y. Bulletin 79-D, introducing the company's Model 65-5 air power notching and punching machine for sheer metal operations. Complete information and specifications are included for this air-powered machine as well as for the company's No. 5-24 hand lever punch and shear. **13**

VISES AND WORK-HOLDING FIXTURES—Universal Vise & Tool Co., Parma, Mich. Catalogue 9156, giving information on the company's line of machine tool vises, angle vises, adjustable angle-plates, adjustable lathe fixtures, safety work-holders for drill presses, quick-acting vises, large-capacity mill table vises, and parallel clamps. **14**

TERMINAL BLOCKS—Curtis Development & Mfg. Co., Milwaukee, Wis. Catalogue 556, describing the company's line of terminal blocks and terminal block kits. Included are suggestions for combinations of various types of terminals within the same block for most convenient terminating of high-current, control, and power circuits in a minimum space. **15**

BOSS FITTINGS—Anchor Coupling Co., Inc., Libertyville, Ill. Catalogue illustrating and describing the company's complete line of SAE boss fittings and O-ring adapters designed to satisfy new SAE straight thread boss standards. A complete line of these adapters is offered in a wide range of sizes and styles. **16**

CIRCUIT BREAKERS—Heinemann Electric Co., Trenton, N. J. Bulletin 3411, describing the company's general-purpose circuit breakers of the hydraulic-magnetic type. Data on basic design considerations, voltage drop curves, interrupting capacities, and similar information is covered in tabular and graphic form. **17**

AIRCRAFT SWITCHES—Micro Switch, Freeport, Ill., a division of Minneapolis-Honeywell Regulator Co. Catalogue entitled "Enclosed Switches for Airborne Equipment," covering twelve different types of precision, snap-action aircraft switches. In all, over seventy different enclosed switches are described. **18**

BALL BEARINGS—Barden Corporation, Danbury, Conn. 64-page catalogue containing extensive information on the company's ball bearings. It includes a dimensional index; a series index; and a visual guide to bearing types, characteristics, and applications, as well as a separate index to selection and engineering data. **19**

GEAR TESTING—Michigan Tool Co., Detroit, Mich. Bulletin discussing the principles and advantages of audio testing of gears, singly or in clusters. Also described are the electronic audio sound testers developed by the company. These testers may be used directly in automated lines. **20**

SPEED RECORDERS—Leeds & Northrup Co., Philadelphia, Pa. Leaflet giving concise information about the company's electronic Speedomax H indicators and recorders now available for precise measurement of rotational or linear speeds, and about the tachometer generators used with them. **21**

SCREW MACHINE PRODUCTS—All-metal Screw Products Co., Inc., Garden City, N. Y. Illustrated folder describing fabrication operations and techniques required for each of the eight illustrated items. Dimensions and tolerances are given. Both cold-headed and screw machine products are included. **22**

LUBRICATED PLUG VALVES—Homestead Valve Mfg. Co., Coraopolis, Pa. 28-page catalogue describing the company's lubricated plug valves in a variety of metals for 150-pound steam working pressure, 200-pound oil-water-gas, and ASA 150- and 300-pound classes. . . . **23**

BRAZING ALLOYS—Handy & Harman, New York City. Brochure giving full specifications, selection factors, recommended applications, and other pertinent data on the company's four Hi-Temp alloys, which are basically nickel alloys having nickel contents ranging from 72.5 to 93.25 per cent. **24**

TIME DELAY RELAYS—A. W. Haydon Co., Waterbury, Conn. Bulletin A.W.H. TD403, giving detailed information on the function of the company's three basic time delay relays, along with catalogue part numbers for the standard ranges and voltages in alternating current, direct current, and 400 cycle. **25**

TUBE END-FORMING MACHINES—Vaill Engineering Co., Waterbury, Conn. Catalogue G4, describing the company's tube end-forming machines: a complete line of air-hydraulic, mechanical operating machines to shape and form the ends of 1/8-inch to 3 1/2-inch diameter tubes. **26**

LINE STRAINER—Ripley Mfg. Co., Croswell, Mich. Bulletin describing the company's line strainer, suitable for practically all liquids, that produces a minimum pressure drop in the line, has large filtering area, and includes a self-cleaning action in the filter element. **27**

TAP-AND-REAMER HOLDER—Seibert & Sons, Inc., Chenoa, Ill. Specification sheet illustrating and describing the company's

Product Information Service

Use postage-free Business Reply Card below for further information on New Catalogues or New Shop Equipment described in this issue and products mentioned in the advertisements.

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1 2 3 4 5 6 7 8 9 10 11 12 13 14
15 16 17 18 19 20 21 22 23 24 25 26 27 28
29 30 31 32 33 34 35 36 37 38 39 40 41 42
43 44 45 46 47 48 49 50 51 52 53 54 55 56
57 58 59 60 61 62 63 64 65 66 67 68 69 70

NEW SHOP EQUIPMENT

101 102 103 104 105 106 107 108 109 110 111 112 113 114
115 116 117 118 119 120 121 122 123 124 125 126 127 128
129 130 131 132 133 134 135 136 137 138 139 140 141 142
143 144 145 146 147 148 149 150 151 152 153 154 155 156
157 158 159 160 161 162 163 164 165 166 167 168 169 170
171 172 173 174

ADVERTISED PRODUCTS

Page .... Advertiser ....
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line of floating tap-and-reamer holders which are designed with fast change collets with a set-screw in the end for use in pre-setting. **28**

HYDRAULIC EQUIPMENT—Century Hydraulics, Inc., Detroit, Mich. Catalogue entitled "Engineered Hydraulic Equipment," containing information on hydraulic reservoirs and hydraulic pumping unit accessories. Dimensional data sheets are included. **29**

PRECISION LAPPING—Penn Scientific Products Co., Abington, Pa. 28-page manual entitled "The Technology of Precision Lapping," illustrating and describing fine diamond abrasives and the accessories required for their use in precision lapping. **30**

HEAT-TREATED THREADING HEADS—Landis Machine Co., Waynesboro, Pa. Bulletin F-90-3, giving detailed information on the company's heat-treated dieheads, both standard and special. Complete specifications and illustrations of each die-head are given. **31**

MICROSPHERE SPINDLE BEARINGS—Landis Tool Co., Waynesboro, Pa. Catalogue MB-56 describing the construction and operation of the company's microsphere wheel spindle bearings which are used on Landis precision cylindrical grinding machines. **32**

DOUBLE-CRANK DIEING MACHINES—Emhart Mfg. Co., Press Division, Henry & Wright, Hartford, Conn. Illustrated folder giving specifications, design features, and roll feed and drive information on the double-crank dieing machines for metal stamping. **33**

SPEED REDUCERS—Sterling Electric Motors, Inc., Los Angeles 22, Calif. 12-page catalogue describing the company's three styles of speed reduction: integral gear-motors; speed reducers with separate motors; and speed reducers alone. . . . **34**

HEAD AND TAILSTOCKS—Worthington Corporation, Plainfield, N. J. Specification sheet giving information on the company's head and tailstocks for welding and assembly, including specifications, general description, and photographs. **35**

SHEET STEEL SEPARATORS—E. V. Nielsen, Inc., Stamford, Conn. Catalogue describing and illustrating Basco sheet steel separators, permanent magnet units which induce a magnetic field in stacked steel sheets and laminations. **36**

RELAYS AND SWITCHES—Jaidinger Mfg. Co., Chicago, Ill. Catalogue describing the company's Jaico switches and relays, ranging in size from standard to miniature, and describing the operation and characteristics of each. **37**

FORGED STEEL UNIONS—W-S Fittings Division, H. K. Porter Co., Inc., Roselle, N. J. Bulletin U-1-56, presenting dimensional and engineering data on the company's line of forged steel unions for high-pressure service. **38**

GEAR-MOTORS—General Electric Co., Schenectady 5, N. Y. Bulletin GEA-6133A, illustrating product features and including gear-motor selection data, dimensions, ratings, and specifications of the company's fractional horsepower gear-motors. **39**

DIAMOND WHEELS AND TOOLS—Delta Diamond Wheel Corporation, New York City. Catalogue 717, describing the company's series of resin- and metal-bonded diamond wheels—steel, nickel, and bronze bonds. **40**

HOOK SCALE—Martin-Decker Corporation, Long Beach, Calif. Bulletin M-25, giving information on the company's SU-20 Sensater hook scale. Weighing operations in several different industries are illustrated. This hydraulic scale is certified for accuracy. **41**

POWDERED METAL PRESS—Watson-Stillman Press Division, Farrel-Birmingham Co., Inc., Roselle, N. J. Bulletin 380, describing features and specifications of the company's Model 6-125 powdered metal press **42**

TAPS—Beloit Tool Corporation, Beloit, Wis. Catalogue covering the company's line of standard and special taps, drills, and gages. Pricing formulas for determining the most economical quantities are given. **43**

OXIDE CUTTING TOOLS—Diamonite Products Division, United States Ceramic Tile Co., Canton, Ohio. Chart recommending speeds and feeds for use in turning various materials with oxide cutting tools. **44**

LATHE ACCESSORIES—Louis Levin & Son, Inc., Los Angeles, Calif. Bulletin R, describing the full line of turret tools for the company's lathes, including releasing tap- and die-holders with shock-free clutches. **45**

CASE CONVEYOR CHAIN—Chain Belt Co., Milwaukee, Wis. Bulletin 56-73, describing the company's Rex 9250 case conveyor chain designed for handling cartons, cases, crates, and cans. **46**

SEALS AND COOLANT SUPPLY SYSTEMS—Sealol Corporation, Providence, R. I. Bulletins Nos. 10 and 17, describing the company's Flexibox seals and Hi-Pressure coolant supply systems, respectively. **47**

CUTTERS AND BLANKS—Edward D. Strand Co., Worcester, Mass. Sales bul-

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letin featuring the company's cutters and blanks for duplicators, milling machines, and pantographs. **48**

WELDING POSITIONER—Worthington Corporation, Harrison, N. J. Leaflet describing the company's precision engineered Model 5P welding positioner for automatic and manual welding. **49**

PRECISION CUTTING MACHINES—Collins Machinery Corporation, Los Angeles, Calif. 6-page catalogue covering the company's complete line of precision cutting and threading machines and saws. **50**

GEARS AND PINIONS—Gries Reproducer Corporation, New Rochelle, N. Y. Bulletin listing the company's die-cast zinc alloy gears and pinions available from stock dies. **51**

ULTRASONIC IMMERSCOPE—Curtiss-Wright Corporation, Caldwell, N. J. Bulletin describing the company's portable, ultrasonic Immerscope test unit for positive quality control. **52**

VALVES—Circle Seal Products Co., Inc., Pasadena, Calif. Catalogue S-2021 R, describing the company's line of valves with technical information and illustrations. **53**

INDUSTRIAL FURNACES—Surface Combustion Corporation, Toledo, Ohio. Catalogue SC-175, describing the company's twenty-seven standard rated surface heat-treating furnaces. **54**

CONVEYOR WHEELS—Grey Hub Trolley Wheel Co., Detroit, Mich. Catalogue describing the company's conveyor wheels available with four types of bearings. **55**

LEVELING JACKS—Enterprise Machine Parts Corporation, Detroit, Mich. Bulletin giving information on the company's leveling jacks. **56**

COMPARATOR—Jerpbak-Bayless Co., Solon, Ohio. Leaflet describing the company's portable, universal, length and width comparator. **57**

POLISHING AND GRINDING WHEELS—Minnesota Mining & Mfg. Co., St. Paul, Minn. 12-page bulletin entitled "Modern Metal Finishing with 3M PG Wheels," covering actual wheel applications in appliance, aircraft, farm equipment, metal furniture, dairy equipment, machinery, and other metalworking industries. **58**

STANDARD METAL SHAPES—Commercial Shearing & Stamping Co., Youngstown, Ohio. 24-page catalogue giving factual information on die-formed standard metal shapes which are being used and adapted to perform innumerable mechanical functions involving specialized design requirements. **59**

TELESYN SYNCHROS—Ford Instrument Co., Division of Sperry Rand Corporation, New York City. 12-page catalogue describing and illustrating the company's line of Size 1, 3, and 5 Telesyn synchros. These units are available as transmitters, receivers, control transformers, and differential units. **60**

BLAST CLEANING ABRASIVES—Pangborn Corporation, Hagerstown, Md. 12-page catalogue dealing with blast cleaning abrasives—their characteristics, application, and selection. **61**

SMALL SEAMLESS TUBING—Uniform Tubes, Inc., Collegeville, Pa. 4-page catalogue covering the company's line of small seamless tubing and tubular components. **62**

RADIAL DRAW-FORMING MACHINES—Cyril Bath Co., Solon, Ohio. Bulletin AHS-956, describing the company's radial draw formers—automatic, high-speed machines producing complex auto parts at rates of 400 to 800 parts per hour. **63**

DRAFTING INSTRUMENTS—Dolgorukov Mfg. Co., Detroit, Mich. Catalogue describing the company's drawing instruments and templates. **64**

FASTENINGS — H. M. Harper Co., Morton Grove, Ill. 24-page brochure describing the company's Flo-Form corrosion-resistant fastenings. **65**

MICRO-PROJECTOR—Opto-Metric Tools, Inc., New York City. 12-page catalogue describing the Wilder micro-projector. **66**

ULTRASONIC HAND TOOL—Sheffield Corporation, Dayton, Ohio. Leaflet describing the company's Model 200-A portable ultrasonic hand tool. **67**

WEIGHING SYSTEMS—A. H. Emery Co., New Canaan, Conn. Bulletin 561, describing the company's tank and bin weighing systems. **68**

SWIVEL JOINTS—Barco Mfg. Co., Barrington, Ill. 12-page catalogue describing the company's expanded line of aircraft type swivel joints. **69**

METAL-CLEANING EQUIPMENT—Solventol Chemical Products, Inc., Detroit, Mich. Bulletin describing specialized metal-cleaning equipment. **70**

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CATALOGUES

1	2	3	4	5	6	7	8	9	10	11	12	13	14
15	16	17	18	19	20	21	22	23	24	25	26	27	28
29	30	31	32	33	34	35	36	37	38	39	40	41	42
43	44	45	46	47	48	49	50	51	52	53	54	55	56
57	58	59	60	61	62	63	64	65	66	67	68	69	70

NEW SHOP EQUIPMENT

101	102	103	104	105	106	107	108	109	110	111	112	113	114
115	116	117	118	119	120	121	122	123	124	125	126	127	128
129	130	131	132	133	134	135	136	137	138	139	140	141	142
143	144	145	146	147	148	149	150	151	152	153	154	155	156
157	158	159	160	161	162	163	164	165	166	167	168	169	170
171	172	173	174										

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15	16	17	18	19	20	21	22	23	24	25	26	27	28
29	30	31	32	33	34	35	36	37	38	39	40	41	42
43	44	45	46	47	48	49	50	51	52	53	54	55	56
57	58	59	60	61	62	63	64	65	66	67	68	69	70

NEW SHOP EQUIPMENT

101	102	103	104	105	106	107	108	109	110	111	112	113	114
115	116	117	118	119	120	121	122	123	124	125	126	127	128
129	130	131	132	133	134	135	136	137	138	139	140	141	142
143	144	145	146	147	148	149	150	151	152	153	154	155	156
157	158	159	160	161	162	163	164	165	166	167	168	169	170
171	172	173	174										

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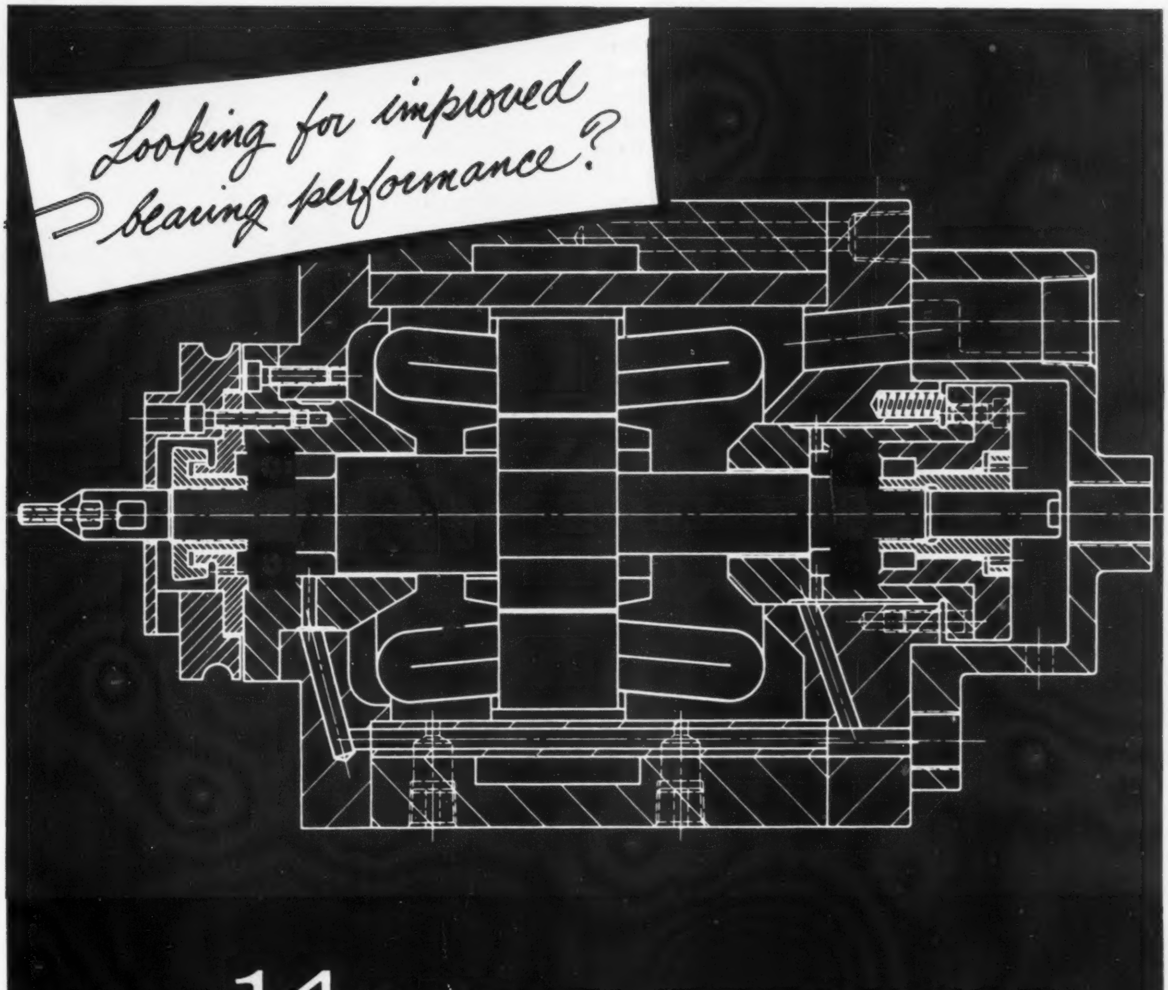

over 14 billion revolutions...

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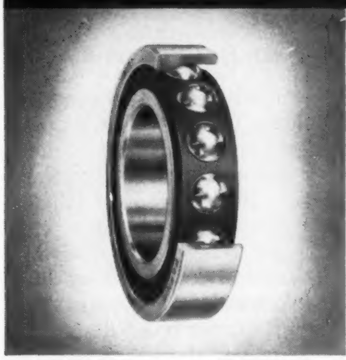

Fafnir Super-Precision MM201W1-CR spring-loaded ball bearing, the type specified for wheelhead illustrated.

Fafnir-equipped, high-speed, oscillating grinder wheelhead demonstrates machine tool progress in performance

This extraordinary record has been made on the production line by a Pope-built wheelhead, grinding the races of extra-precision ball bearings. The hi-frequency motorized wheelhead operates at 72,000 rpm. The motor is water-cooled and bearings lubricated by means of an oil-air mist system.

When designing this oscillating grinder wheelhead, Fafnir engineers worked together with the Pope Machinery Company engineers in the selection and application of bearings. The type of bearing recommended is shown at the left and its application in the drawing above. Its performance record, according to Pope, demonstrates progress to match today's improved machine tools.

Whatever your bearing problem, a few minutes spent with a Fafnir representative may be the means of solving it as successfully. Write The Fafnir Bearing Company, New Britain, Connecticut.

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BALL BEARINGS

MOST COMPLETE LINE IN AMERICA

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oil-resistant rubber diaphragm in the operator head to completely seal out oil, water, and dust.

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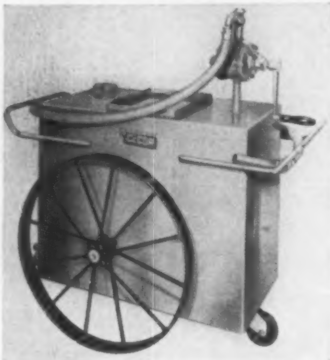


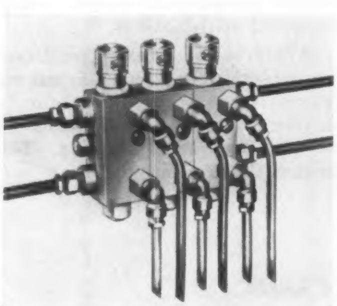
Mobile Liquid Dispenser

Transporting and dispensing coolants, hydraulic fluids, and other liquids can be accomplished by one man without spillage with the CeCOR mobile dispenser manufactured by the Coolant Equipment Corporation, Verona, Wis. The tank unit, which turns in a 48-inch circle, is mounted on either 12-inch diameter rubber-tired wheels or 30-inch diameter steel wheels. It has a capacity of 80 gallons and is available with either hand or electrically operated pumps delivering 15 gallons per minute. One- or two-way pumps may be specified on all models. Electrically operated Model 210 is also available with valving which permits the mixing of liquids within the tank.

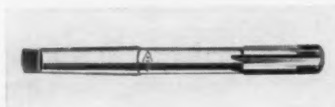
Circle Item 156 on postcard, page 225

Lubrication Cycle Counter

A lubrication cycle counter has been announced by the Alemite Division of the Stewart-Warner Corporation, Chicago, Ill. The lubrication-recording cycle counter (used with Type II Accumatic centralized lubrication systems) registers the exact number of times that the lubricant valve is discharged, revealing at a glance that the lubrication system is functioning at precisely the predetermined intervals selected to meet specific requirements. It provides a permanent operational record of each valve. The compact unit screws into the valve and extends 1 5/8 inches above it when in operation. The counter face swivels to any position for easy reading. When the counter reaches 99, it automatically resets to zero.



Circle Item 157 on postcard, page 225



Whitman & Barnes Carbide Dowel-Pin Reamer

Carbide dowel-pin reamer now offered in a complete selection of sizes by Whitman & Barnes, Plymouth, Mich. These reamers are designed specifically for reaming operations in die steel having a hardness of from 45 to 65 Rockwell C. They are said to eliminate the need for grinding, lapping, or honing. Dowel-pin holes can be drilled under size, the piece hardened, and the holes reamed accurately to size with the new reamers. No further processing is required. The reamers can also be used for enlarging or reaming operations in other hardened parts. They are available in 1/4-, 5/16-, 3/8-, 1/2-, 5/8-, and 3/4-inch diameters.

Circle Item 158 on postcard, page 225

Ross Palm-Operated Button Valve

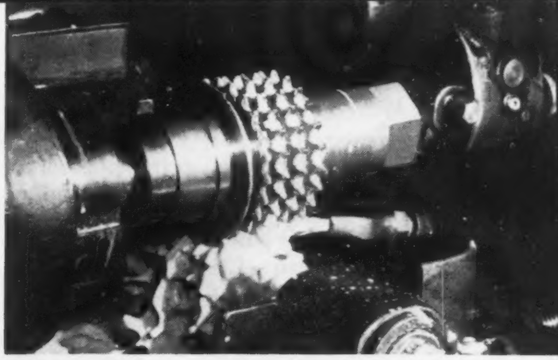
Leakproof, palm-operated button valve made by Ross Operating Valve Co., Detroit, Mich., for general applications which require a normally closed straight-way or three-way hand-operated pilot valve. This valve was designed specifically for use in cir-

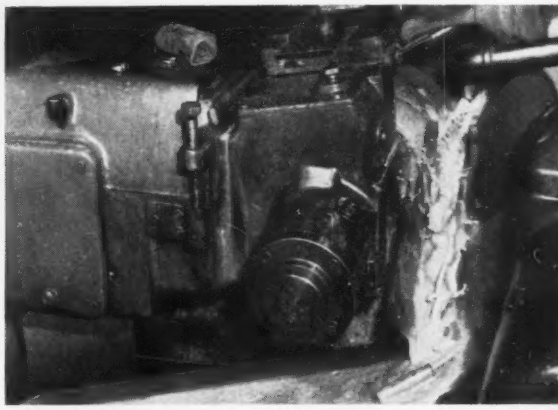
cuits where safety is of prime importance. It can be provided with a tumbler type lock, enabling the valve to be locked by authorized personnel in either the open or closed position. Although side-ported for 1/4-inch National pipe threads, its over-all height is only 2 3/8 inches. The three-way model has a non-piped exhaust, and both straight-way and three-way valves have a 1/4-inch diameter flow capacity.

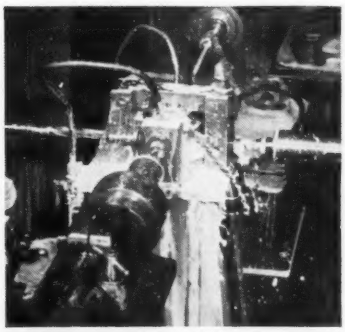
Circle Item 159 on postcard, page 225

Push-Button Switch

Push-button switch for use in computers, vending machines, appliances, and industrial machinery, announced by Micro Switch, Freeport, Ill., a division of Minneapolis-Honeywell Regulator Co. This pre-assembled, ready-to-install switch features long life, high electrical capacity, snap action, and tamper-proof design. It has a plastic button which is keyed to prevent rotation and may be detached and engraved by the user. Tapped holes allow the switch to be mounted on panels by two screws on 1 1/2-inch centers. An over panel may be used to cover mounting screw or rivet heads and leaves only the

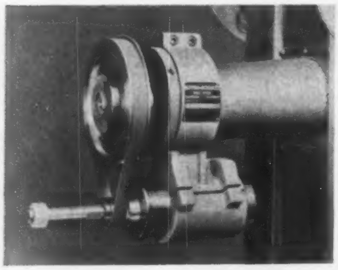






button exposed. Spade type, quick-connect terminals permit fast, simple wiring. Contact arrangement is single-pole, double-throw. Electrical rating of the switch is 15 amperes, 125- or 250-volt alternating current—1-H.P., 250-volt alternating current and 1/2-H.P., 125-volt alternating current.

Circle Item 160 on postcard, page 225



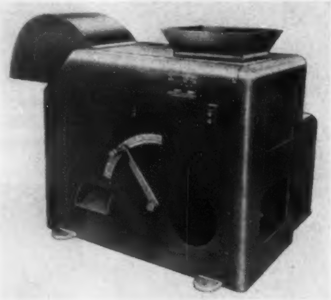
High-Speed Grinding Attachment

The Boyar-Schultz Corporation, Broadview, Ill., has brought out a new high-speed grinding attachment for use with surface grinders. It is intended for the grinding of angles or slots too small to permit the use of standard size grinding wheels and also for the grinding of serrations, T-slots, and many other hard-to-get-at surfaces. The attachment has a spindle speed of 14,000 R.P.M. It can also be used for grinding small radii and small contours in die-blocks or other parts requiring this type of work. Mounting of the unit on a surface grinder spindle requires only a few minutes. Belt tension is adjusted by an eccentric bushing, and the spindle has permanently lubricated ball bearings.

Circle Item 161 on postcard, page 225

Chip Separator for Screw Machine

An intermediate floor model chip separator has been manufactured by the McKenzie Engineering Co., Newtown, Conn., to separate automatic screw machine parts from waste chips. The unit combines high-production automatic feed with the versatility required by jobbing shops. A centrifugal blower unit has forty air settings to provide clean separation and accurate control for screw machine parts having diameters ranging from 1/16 to 3/4 inch



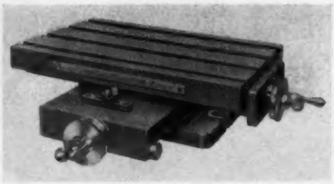
and lengths from 1/4 to 3 1/2 inches. Parts and chips are fed to the separation area at a maximum rate of 1/2 cubic foot per minute, where they are immediately separated. Work-pieces are delivered at the side of the machine directly into tote pans, and the salvaged chips are discharged at the front of the machine.

Circle Item 162 on postcard, page 225

Goddard & Goddard End-Mill Adapters

Heavy-duty adapters to accommodate a new series of end-mills for aluminum having 1 1/2-inch shanks are now available from Goddard & Goddard Co., Detroit, Mich. The adapters fit a No. 50 spindle taper. Flange mounting provides a quick-change feature by eliminating the use of a draw-in bolt. Two set-screws firmly hold the end-mill shank. Locating surfaces are ground parallel and concentric for true mounting and accurate cutting.

Circle Item 163 on postcard, page 225



Precision Cross-Slide Table

Lawrence H. Cook, Inc., East Providence, R. I., has introduced a 65-pound precision cross-slide table. It fits all rotary tables with a diameter of 12 inches or more and can be used for radii and angle milling on all vertical milling machines. Four T-slots are provided along the 8- by 12-inch table top, with the entire unit standing only 4 inches high. The lead-screws have hardened and ground threads, and the ways and top are hand-scraped.

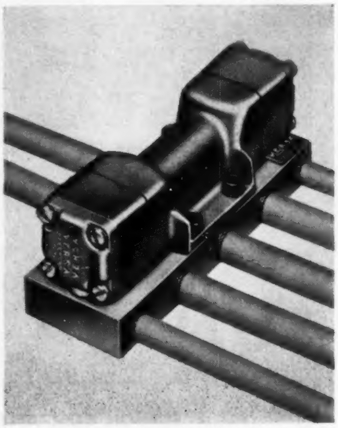
Circle Item 164 on postcard, page 225

Manifold-Mount Control Valves

Versa Products Co., Inc., Brooklyn, N. Y., has brought out a complete line of manifold-mount control valves in two-, three-, four-, and five-way types in sizes from 1/8 to 1 inch National Pipe Thread. These are designed for installations where space is at a premium and where speed of removal and reinstallation is required. All piping can be installed, connected to manifold plate, and even purged before installation of the valve itself.

Circle Item 165 on postcard, page 225

(This section continued on page 234)



BRIDGEPORT BRASS COMPANY

COPPER ALLOY BULLETIN

Bridgeport Brass Co.

Reporting new developments in copper-base alloys and metalworking methods.

These copper wall tiles made from Bridgeport copper are ideal where rich, warm decoration is desired. (Photo courtesy House of Time, Inc.)

Bridgeport Copper Gives Gleaming Beauty to Vikon Tile

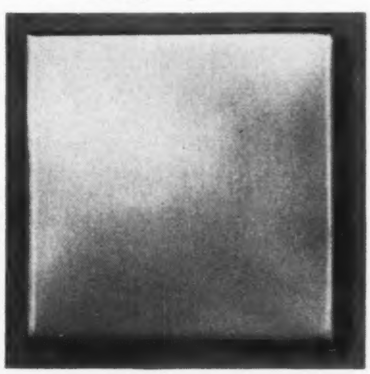
Vikon Tile Co., Washington, N. J., manufactures a complete line of metal and plastic tile. For their copper tile, widely used in kitchens and for decorative effects, it was important that the material chosen fit very exacting requirements—and Bridgeport Copper met those specifications.

The copper had to be easy to cold-work and have the right temper to give the desired rigidity after forming. It had to have a consistently unblemished surface to assure a uniform finish. Ease of lacquering was also important.

For these tiles, Bridgeport recommended and supplied Alloy #102, 28 gage (.0126 in. thick) roll copper.

The roll copper is first put through a passifator bath to retard tarnishing. After drying, the passifated copper is sent to presses for stamping. The stamped tiles then go to the spray department where they are coated front and back with a clear synthetic lacquer. This finish is baked on the surface, and serves as a further protection against tarnishing.

This is another successful example of a Bridgeport metal that is *matched to the job*. Vikon, like other manufacturers, has found Bridgeport a dependable source of quality material.



Finished tiles have a beautiful satin-like sheen. The burnished surface allows tiles to be alternately placed to obtain checkerboard patterns.

Railhead Bond Made From Bridgeport Phono-Electric Rod Gives Dependable Service

Hanlon & Wilson Co. of Wilkinsburg, Pa., manufactures their quality rail bond from Bridgeport Phono-Electric Cadmium Copper, Alloy #985.

For the terminals, Hanlon & Wilson needed a metal that had a coefficient of expansion approximating railroad steel . . . one that had excellent cold-flow properties as well as high conductivity. High strength and maximum resistance to corrosion were also desirable qualities.

Bridgeport Technical Service studied the requirements for the rail bond, then suggested Alloy #985, Phono-Electric Cadmium Copper rod, in $\frac{1}{2}$″ diameter. Terminals were drilled through, pressed in three operations and rotary swaged to the cable. The cable strand is made from Alloy #985 wire.

Hanlon & Wilson Co. rail bonds are shown before plating (at left) and after plating (at right).

Both in manufacturing processes and in actual use, Bridgeport Alloy #985 proved to be entirely satisfactory. Why? Because the metal is *matched to the job it is expected to do*. This metallurgical service is available to you without obligation. Just phone or write your nearest Bridgeport Sales Office for expert advice . . . and for high-quality brass, copper and aluminum. (013)

BRIDGEPORT BRASS COMPANY ♦ BRIDGEPORT, CONNECTICUT

Mills at Bridgeport, Conn., Indianapolis, Ind., and Adrian, Mich. Sales Offices in Principal Cities—Conveniently Located Warehouses

For more Information fill in page number on Inquiry Card, on page 225

Automatic Read-Out Micrometer

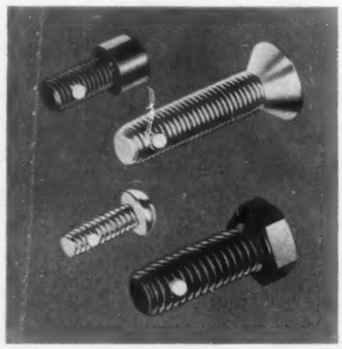
Carson-Dice digital read-out electronic micrometer designed to eliminate the final source of human error in precision measurements—the mental interpretation of a dial or scale position into the digits of a decimal dimension. With this instrument, the exact dimension of a part is determined because the instrument is not influenced by the three human variables—sense of touch, muscular power, and interpretation of scale or dial reading. An electronic circuit responds at the instant of contact between the micrometer anvil and the work before any pressure is built up on the work by the micrometer screw. A motor drive unit automatically brings the micrometer precisely to the point of contact at a speed much faster than can be done manually. The relative position of a zero line and a calibrated scale is translated into a decimal dimension. The digital read-out counter on the front of the instrument displays the exact reading in ten-

thousandths of an inch. Five divisions between each digit on unit wheel permit readings to 20 millionths of an inch. Made by J. W. Dice Co., Englewood, N. J.

Circle Item 166 on postcard, page 225

Nylok Self-Locking Fasteners

Self-locking, self-sealing Nylok screws, bolts, and other threaded parts are being offered by the Nylok-Detroit Corporation, Birmingham, Mich. The locking medium is a resilient, protruding nylon pellet permanently inserted in the body of the threaded part. When mating parts are engaged, the springlike wedging action of the nylon pellet locks the mating

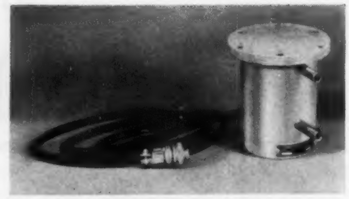


threads together. Locking torque is smooth and uniform with no galling or damage to threads or seating surfaces. The fasteners have also demonstrated an ability to seal against leakage, the nylon pellet acting as an effective dam to the flow of oil, hydraulic fluid, water, or air along the helical path of the threads.

Circle Item 167 on postcard, page 225

Magnetostriction Transducer

A high-power magnetostriction type transducer for large-scale ultrasonic cleaning, degreasing, descaling, plating, and other metalworking and finishing operations has been made available to industry by Acoustica Associates, Inc., Glenwood Landing, L. I., N. Y. This 400-watt, 25.9-kilocycle transducer can be used with a mating stainless-steel jar or can be externally mounted on a tank or trough. Several units can be driven in tandem by matching frequency generators ranging in power from 400 to 10,000 watts. Only the Teflon face—which is impervious to solvents, most strong acids and alkalis, and other cor-



rosive cleaning media—is in contact with the solution. Average r.f. power applied to the transducer is 66 watts per square inch of radiating area. Water cooling eliminates any drift in frequency or loss in output. Maximum magnetostrictive stack motion is obtained through the use of a closed magnetic path core construction that minimizes leakage inductance.

Circle Item 168 on postcard, page 225

Counterbalance Cylinders for Punch Presses

The Dayton Rogers Mfg. Co., Minneapolis, Minn., has announced an improved line of power press counterbalance cylinders, known as the Model L. They have universal installation application to all power presses and can be installed by any one of four universal methods. Drop, or over-ride, of the press ram due to either its own weight or the additional weight of the attached tools is eliminated. Wear of the punch press brake caused by excessive brake pressure is reduced and break-through is eliminated.

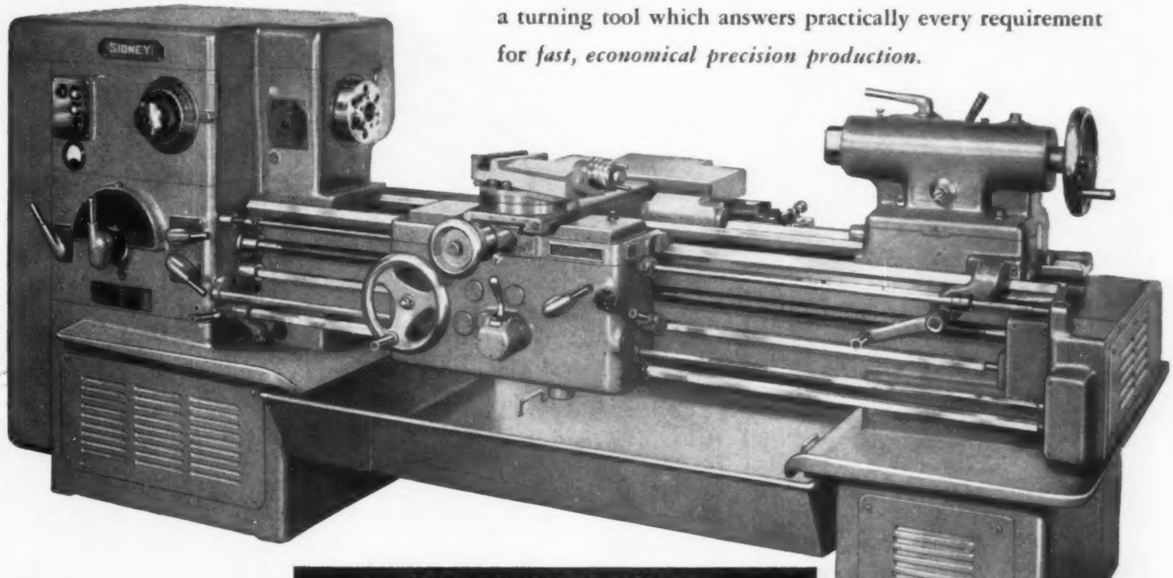
Circle Item 169 on postcard, page 225

(This section continued on page 238)

SIDNEY DIAL-MASTER LATHE
MODEL 32

SIDNEY'S LATEST TRIUMPH IN MODERN TURNING

The proved and approved answer to industry's demand for a turning tool which answers practically every requirement for *fast, economical precision production.*



DIAL-MASTER offers:

- DIAL CONTROL — 32 pre-selective spindle speeds
- Increased capacity • Added rigidity
- Increased size spindle diameter, tailstock, apron and carriage and bed design
- Simplified feed and thread control arrangement
- Single operational apron control lever for feed and quick traverse in four directions for maximum convenience of operator
- Complete range of 60 thread and feed changes

THE SIDNEY MACHINE TOOL COMPANY · over 50 years of service to AMERICAN INDUSTRY · SIDNEY · OHIO

Also available with THE SIDNEY FLUID TRACER ATTACHMENT which provides tremendous savings in cost per finished piece on small or quantity runs. Tracer motor may be turned off while the machine is performing standard lathe work.

SIDNEY

THE SIDNEY MACHINE TOOL CO. SIDNEY OHIO U.S.A.

Write for new bulletins or ask for representative to call at your convenience

THE SIDNEY MACHINE TOOL CO.

Builders of Precision Machinery since 1904

Sidney, Ohio

For more information fill in page number on Inquiry Card, on page 225

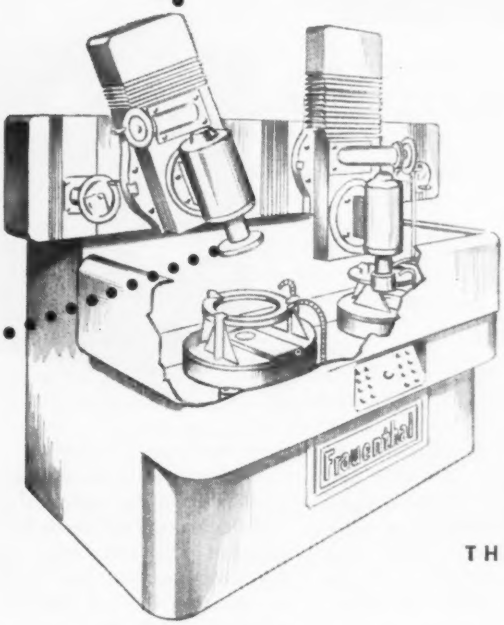
at any angle!

Frauenthal's creative engineering Now makes available Standard Slide Units in any number of combinations for production grinding applications . . .

IT IS NO LONGER NECESSARY to absorb special engineering and design costs when Frauenthal Standard Slide Units — plus a variety of grinding spindles — can be assembled to machine bases appropriate to a particular job. And these standard slides in single or multiple units can be arranged in an infinite number of spindle positions to accommodate an endless variety of simultaneous or sequenced, automatically controlled grinding operations.

What's more, you get all the advantages of Frauenthal's advanced engineering and design experience—proven on single and multiple-head grinders used on special production jobs. For example: parts for jet engines, diesel and automobile engines, tanks, gun mounts, radar units, large and small diameter precision bearings and machine tool components.

As illustrated here, this model of the versatile grinding compound shows how the Frauenthal Standard Slide Unit can be adapted to approach the work from any desired angle.



Here's a typical Frauenthal Double Head Vertical Spindle application utilizing two of the Frauenthal Standard Slide Units shown on the opposite page. Although applied to a particular grinding situation, these slide units retain versatility for angular positioning. Frequently, as indicated in panels 2 and 4 at the bottom of the page, diameters and adjacent surfaces are ground at one time with a single wheel dressed to the proper contour.

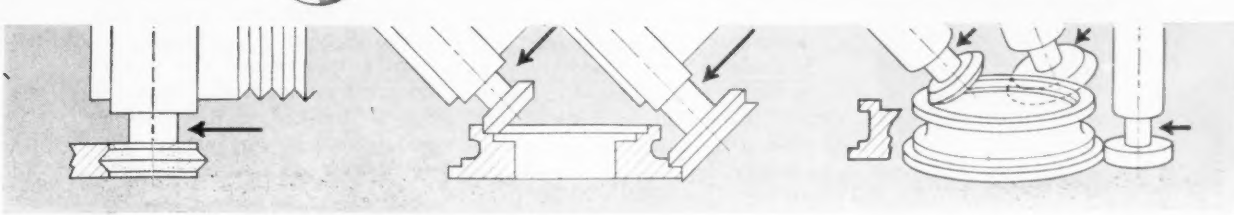
Send a print of your "problem grinding part" and our engineers will show you how to apply Frauenthal Standard Slide Units to solve the problem. Include in your letter pertinent production information — number of pieces, etc. Be sure to investigate the latest Frauenthal Vertical Grinders with Standard Slide Units. For complete details, contact Frauenthal of Muskegon.

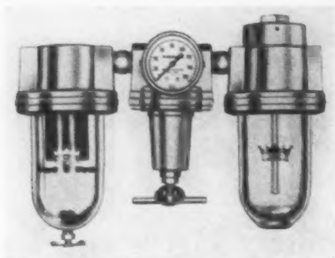
Frauenthal Division

THE KAYDON ENGINEERING CORP.

MUSKEGON, MICHIGAN, U. S. A.

F-256





Hannifin Filter-Regulator-Lubricator Units

Hannifin Corporation, Des Plaines, Ill., has introduced a Crown line of filter-regulator-lubricator combination units. Designed for use in compressed air lines, these units are of modern design and simplified construction and offer many advantages to users of air cylinders, air presses, and air tools. The combination units are available in seven styles for pipe sizes ranging from 1/4 to 1 inch, and the regulator is offered in 1 1/4- and 1 1/2-inch pipe sizes also.

Circle Item 170 on postcard, page 225

Ruthman Pump and Tank Unit

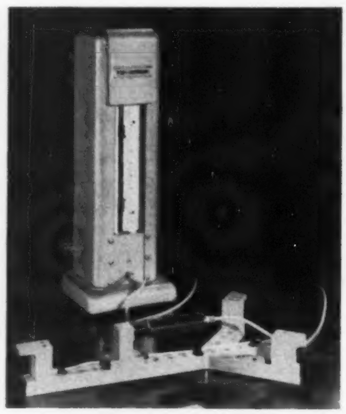
Pump and tank unit No. 4072-T developed for safe handling of abrasive solutions used on honing, lapping, and ultrasonic machines. The assembly consists of a 1/10-H.P. gusher centrifugal pump, a sturdy steel tank complete with inlet and discharge pipe connec-

tions, and an electric cord and plug. The tank is available in all stainless-steel or standard carbon steel to meet the specific requirements of the user.

Circle Item 171 on postcard, page 225

Sheffield Gage Spindle for Large Bores

The Sheffield Corporation, Dayton, Ohio, has introduced a lightweight, spider type spindle for use with a single-column, pneumatic "Precisionaire" instrument

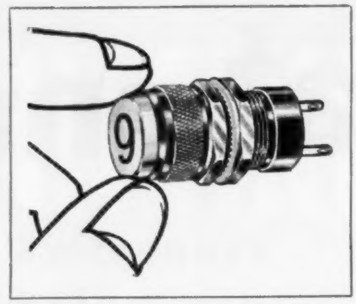


to check large bore diameters. In one application, the spindle checks a dimension of 17.904 to 17.906 inches. Two "Balljets" are used as gaging contacts for this equipment.

Circle Item 172 on postcard, page 225

Miniature Indicator Lights

Small, compact indicator lights are available from the Dialight Corporation, Brooklyn, N. Y. They have an over-all measurement of 1 1/4 by 9/16 inch. A figure, letter, or word can be hot-stamped into the flat face of the translucent plastic lens. Since the light bulb is just below the surface of the lens, a bright and even distribution of light is obtained. The lens assembly is spring-mounted and is made to rotate smoothly so as to enable positioning after the entire pilot light is screwed into place. In this way, the hot-stamped legend is brought into perfect alignment with a mini-

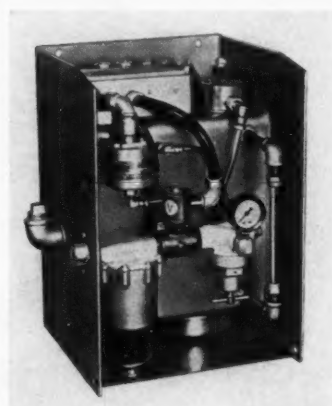


mum of effort. The lens assembly unscrews for easy lamp replacement.

Circle Item 173 on postcard, page 225

Alemite Oil-Mist Lubricators

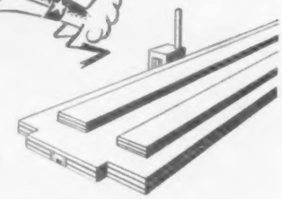
Two Oil-Mist lubricators, designed to provide continuous lubrication for up to 300 and 500 bearing-inches of lubricated mechanisms while consuming but a small amount of oil, have been announced by the Alemite Division of the Stewart-Warner Corporation, Chicago, Ill. The lubricators operate efficiently whether



in a compact installation or extended over a distance of 400 feet —with automatic control of all operating conditions. Built-in safety switches respond instantly for maximum machine life. Air is used to atomize the oil into a mist which is distributed through tubing to all types of mechanisms requiring lubrication. The unit is operated automatically from the "on-off" switch on the machine and has no moving parts to become worn and need replacement.

Circle Item 174 on postcard, page 225

BETWEEN GRINDS



By E. S. Salichs

Merry, Happy, Gay

New Year, Season, Christmas. Mix or match them, but be sure to have them. That's our Yuletide wish to MACHINERY's readers.

Sharp Curves and Pictures

What goes on underneath an automobile when it is taking a corner sharply or bouncing over a rough test road? General Motors research engineers now know because a small television camera on a closed circuit, attached to the under side of the front or rear bumper of the car, transmits the picture to a 14-inch monitoring screen installed in the car. The engineers sit in the back seat of the car and observe the action going on beneath them. Remote telecasts are also possible for observers who prefer sitting at their desks to battling seat springs.

Ores in Oils

"Paintings of an Industry" was the title given to an exhibit of nineteen paintings which an English artist, Terence Cuneo, had been commissioned to paint for the International Nickel Co. Inco wanted its operations in mine, plant, and laboratory portrayed on canvas. The paintings were shown at the Grand Central Art Galleries in New York City.

Driving Over Roads and Road Beds

Eight-wheeled Buicks are being used in riding the rails of the Chicago, Burlington & Quincy Railroad. Since the automobiles can both ride the Burlington tracks and travel on highways, they expedite inspectors' time in covering the sprawling system of main line and spurs. The double set of wheels operates only when the Buick is on the tracks. For highway use, the extra pairs of flanged wheels mounted on the front and rear ends of the automobile are raised hydraulically.

What a Rocket

Planes, official publication of the Aircraft Industries Association of America, Inc., reports that the Government recently initiated Project Vanguard, which charges the aircraft industry with "developing a rocket capable of establishing an artificial orbiting satellite in outer space, which will travel at the incredible speed of between 17,000 and 18,000 miles per hour, completely circling the earth in about ninety minutes." Non-stop?

Dials Save Trials

A carbide and high-speed steel tool manufacturer, the O. K. Tool Co., Inc., of Milford, N. H., has installed a new Carboloy machinability computer to provide its customers with a scientific engineering service in machining operations. Customers fill in forms with the information they have concerning a specific machining job. O. K. manipulates dials of the computer and supplies the customers with machining standards for job-shop operations, thus getting around the usual time lag between purchase and performance of new tools. The Carboloy computer bases its answers on years of laboratory and practical research.

Splatter Patter

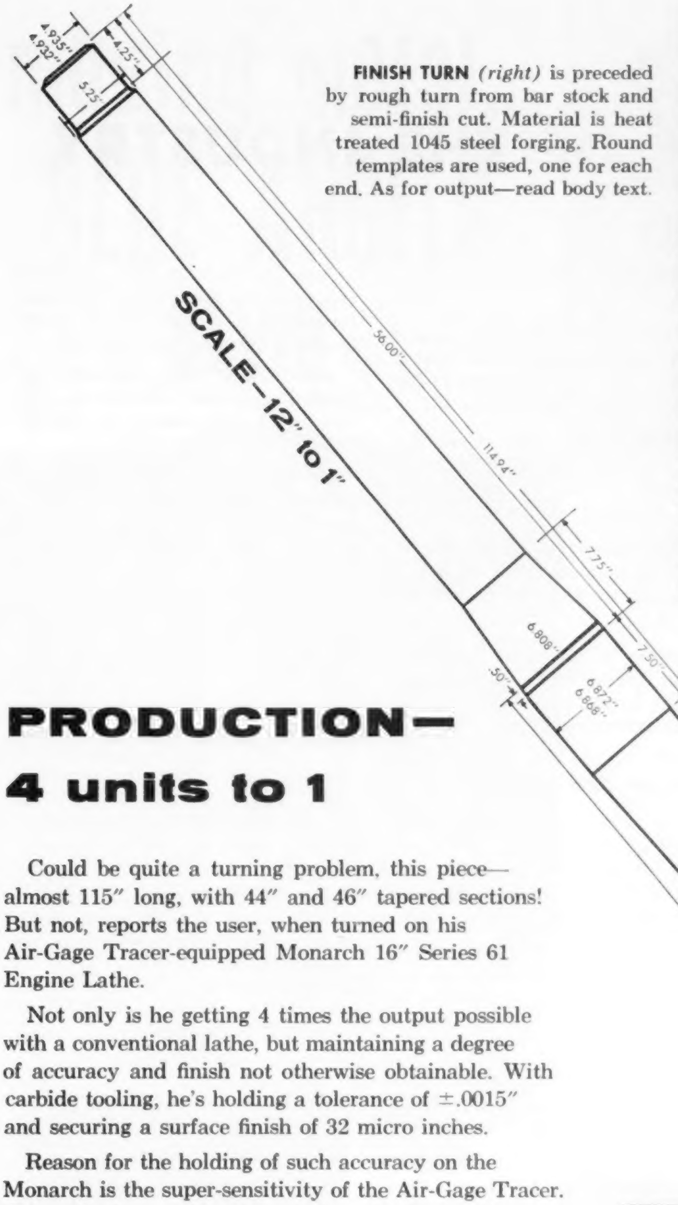
By way of illustrating "Nobody Reads the Directions," a good article in May *Better Homes and Gardens*, the story is told of a woman who wanted to use her vacuum cleaner as a paint sprayer. Neglecting to read the directions which told her to attach the hose to a special exhaust connection, she blithely filled her sprayer attachment with red enamel paint and flipped the foot-switch. Since the vacuum cleaner company heard about it, she evidently lived to spray another day.

It's Later Data Than You Think

Twelve years ago, MACHINERY received a letter requesting certain data which only recently became available. The material was duly published in the October Data Sheet. Our staff had kept the letter on file, and so a copy of the Data Sheet was forwarded to the correspondent. Surprise!

For That Golden Glow

When the Simpson Electric Co. recently celebrated its fiftieth anniversary at its annual sales conference, a toast was drunk in "Goldwasser," a liqueur containing flakes of actual gold. Sift, I mean, sniff this.



FINISH TURN *(right)* is preceded by rough turn from bar stock and semi-finish cut. Material is heat treated 1045 steel forging. Round templates are used, one for each end. As for output—read body text.

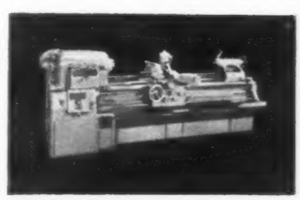
PRODUCTION—
4 units to 1

Could be quite a turning problem, this piece—almost 115″ long, with 44″ and 46″ tapered sections! But not, reports the user, when turned on his Air-Gage Tracer-equipped Monarch 16″ Series 61 Engine Lathe.

Not only is he getting 4 times the output possible with a conventional lathe, but maintaining a degree of accuracy and finish not otherwise obtainable. With carbide tooling, he's holding a tolerance of ±.0015″ and securing a surface finish of 32 micro inches.

Reason for the holding of such accuracy on the Monarch is the super-sensitivity of the Air-Gage Tracer. The exclusive combination of air and oil control found on this device requires a stylus pressure of only 5 to 6 ounces against the template. Add to this the further design feature of both air and oil in constant motion and you have instantaneous power cylinder response to the slightest change in template shape.

Now—about your turning requirements! We've got the machines and the tracer controls to better almost any conventional setup. Why not bet a three cent stamp against almost unlimited production improvement? Let us prove it . . . ***The Monarch Machine Tool Company, Sidney, Ohio.***



Monarch

ACCURACY • ECONOMY • LONG LIFE

TURNING MACHINES

FOR A GOOD TURN FASTER . . . TURN TO MONARCH

For more information fill in page number on Inquiry Card, on page 225

News OF THE INDUSTRY

California and Texas

NORTHROP AIRCRAFT, INC., Hawthorne, Calif., announces the following appointments: ROBERT W. ROLFE has been named assistant to the vice-president of administration. He was formerly base administrator of the company's Edwards Air Force Base, Calif., and succeeds F. PENN HOLTER, who has been appointed to an executive position with Radioplane Co. of Van Nuys, Calif., a Northrop subsidiary. JOHN J. FARLEY, formerly chief of production flight test and assistant base administrator at Northrop's Palmdale, Calif., facility, has been named to succeed Mr. Rolfe.

JACK ROSENBERG has been appointed manager of automation, Electronic Control Systems, Inc., an affiliate of Stromberg-Carlson, and a subsidiary of General Dynamics Corporation, Los Angeles, Calif.

MARVIN C. BONINE has been appointed manufacturing manager for the Pacific Switchgear Division, Federal Pacific Electric Co., San Francisco, Calif.

BAKER-RAULANG CO., Cleveland, Ohio, announces that its Texas branch office has moved to 1703 Levee St., Dallas, Tex. M. S. STEVENSON, formerly a district sales manager, was appointed manager of this branch.

Illinois and Missouri

JOSEPH T. RYERSON & SON, INC., Chicago, Ill., announces a number of changes in its general office management staff: GEORGE E. HANDTMANN has been appointed assistant to the president; JAMES E. DITTUS was named director of quality; ROLLA R. ROSS, manager of systems; GEORGE D. MOODY, office manager; and GEORGE H. BLANK, assistant to general office manager.

H. R. LEBER has been elected a vice-president of SUNDSTRAND MICHIGAN CORPORATION, a wholly owned subsidiary of Sundstrand Machine Tool Co., Rockford, Ill. In addition to his new duties, Mr. Leber will continue as general sales manager of the Machine Tool Division of Sundstrand.

JOHN E. LANE has been named district sales manager of the Detroit district for the Fastex Division of Illinois Tool Works, Des Plaines, Ill.

PETTIBONE MULLIKEN CORPORATION, Chicago, Ill., announces the acquisition of the MERCURY MFG. CO. of the same city.

H. M. HARPER, JR., has been appointed assistant to the president of H. M. Harper Co., Morton Grove, Ill.

CHARLES M. HAWKINS, plant manager of Ehrhardt Tool & Machine Co., St. Louis, Mo., has been appointed general manager.

Michigan and Indiana

HUCK MFG. CO., Detroit, Mich., has appointed ALLEN R. TENNY, eastern division sales manager, and WILLIAM MESSER, midwest division sales manager.

IRVIN R. SPANGLER has been appointed assistant sales manager for the machine and tools division of Michigan Tool Co., Detroit, Mich.

JUEL M. RANUM has been appointed to the new position of director of public relations for the Whirlpool-Seeger Corporation, St. Joseph, Mich.

DETROIT BROACH & MACHINE CO., Detroit, Mich., is building a 15,000-square foot addition to its plant in Rochester, Mich.

LA SALLE STEEL CO., Hammond, Ind., announces the following changes in its organization: T. LLOYD KELLY becomes chairman of the board in the Chicago, Ill., branch; THOMAS A. KELLY, former executive vice-president, has been elected president and chief operating officer.

New York and New Jersey

DAVID H. LYALL has been elected treasurer of Air Reduction Co., Inc., New York City. Mr. Lyall has been with the company for twenty-one years.

A. L. COULSON has been appointed vice-president of sales of the Ford Instrument Co., Division of Sperry Rand Corporation, New York City.

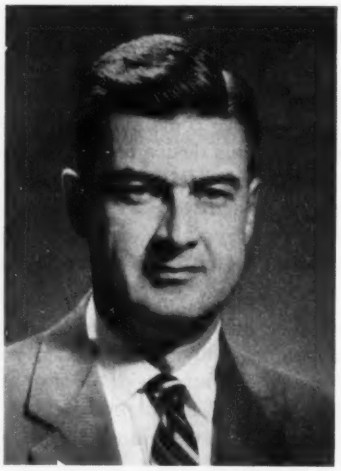
HOWARD A. REID has been appointed executive assistant to the vice-president in charge of sales for Walworth Co., New York City.

PAUL M. PLATZMAN has been appointed vice-president of sales and manufacturing for the Acoustica Associates, Inc., Glenwood Landing, N. Y.

WILLIAM RAINEY has been appointed manager of new product development for the W-S Fittings Division, H. K. Porter Co., Inc., Roselle, N. J.

New England

DOUGLAS R. STARRETT has been elected executive vice-president of the L. S. Starrett Co., Athol, Mass. Mr. Starrett began his service with the company as an apprentice toolmaker and, after serving in World War II, returned to the company as methods engineer, followed by the positions of chief methods engineer, assistant vice-president, and vice-president in charge of plant operations. Mr. Starrett is a great-grandson of the founder of the company.



Douglas R. Starrett, executive vice-president of L. S. Starrett Co.

(*This section continued on page 248*)

mOving metal... BLUE ANGELS' Style

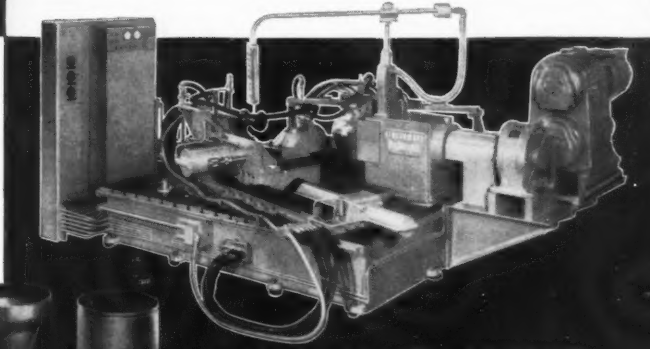
U. S. NAVY PHOTO

With maximum separation of five feet between each plane, the "Blue Angels" demonstrate precision tactical techniques of naval aviation at speeds of 500 mph and better. This famous team of Navy pilots has thrilled millions of aviation enthusiasts with its "minimum altitude" performances of close order precision flying.

To a constantly increasing number of manufacturers, particularly aircraft and jet engine builders, moving metal by The Cincinnati Milling Machine Company's *Hydroforming* and *Hydrospinning* processes is equally dramatic. Formerly difficult-to-make aircraft, engine, missile and other components are being produced in rapid development time . . . with savings of 50% and more in tooling, materials and labor. These part shapes range from simple to highly complex, formed from a wide range of metals. For detailed information on Hydroforming and Hydrospinning, call in a Process Machinery Division field engineer.

CINCINNATI® 19" HYDROFORM®

JET ENGINE PART of 22 gage Inconel, Hydroformed in two operations. A punch, contoured to the part shape, and a simple draw ring, were the only tools required. Hydroform machines are built in 8", 12", 19", 23", 26" and 32" sizes.



CINCINNATI 42" x 50" HYDROSPIN®

NOZZLE, Hydrospun from a wrapped and welded tube (shown at right) of AISI 4130 steel in four passes. Hydrospun parts, having undergone a severe shear deformation, possess increased strength, hardness and resistance to fatigue.

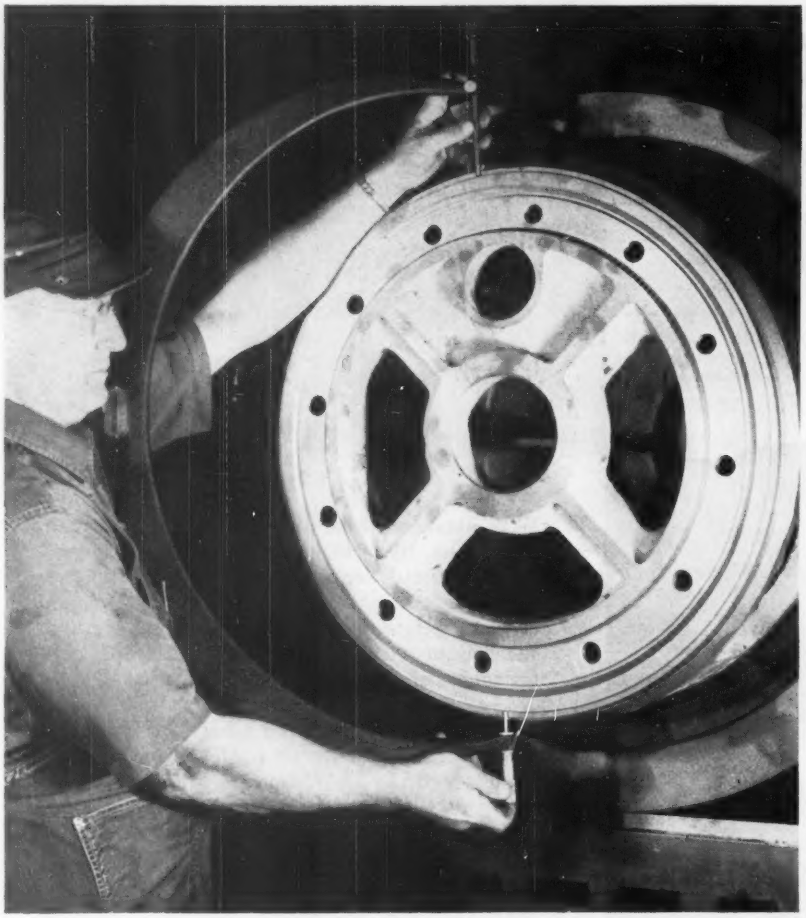
CINCINNATI

Hydroform · Hydrospin

PROCESS MACHINERY DIVISION

THE CINCINNATI MILLING MACHINE CO.

CINCINNATI 9, OHIO, U. S. A.



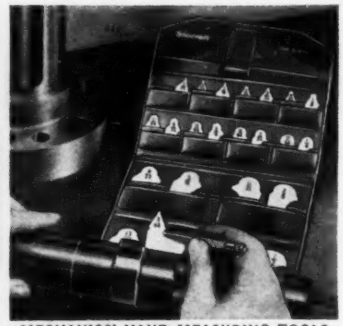
PRECISION COMES EASIER WHEN TOOLS BEAR THIS NAME... Starrett

Ever notice how your best men insist upon Starrett Tools at the crib . . . and won't take anything but Starretts when they buy tools for their own kits? The reason is obvious . . . Starrett Tools sharpen their skill — make it easier to be accurate.

You'll find the Starrett name on a complete line of precision-made products — precision measuring tools, dial indicators and gages, steel tapes and rules, hacksaws, hole saws, band saws, band knives and precision ground die and flat stock. And Starrett Tools are always available through a convenient and reliable source of supply . . . your local Industrial Supply Distributor.

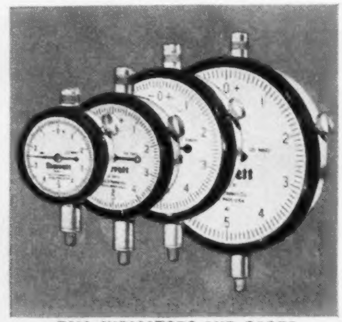
BIG NEW CATALOG NO. 27

Describes and illustrates the complete Starrett line. Ask your Industrial Supply Distributor or write for free copy. Address Dept. D, The L. S. Starrett Company, Athol, Massachusetts, U. S. A.



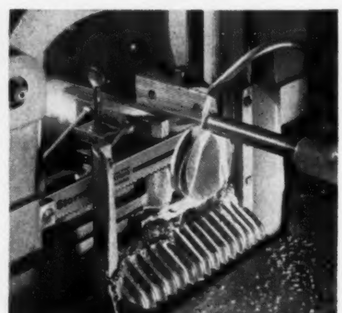
MECHANICS' HAND MEASURING TOOLS AND PRECISION INSTRUMENTS

More than 3000 fine tools for every precision measuring need.



DIAL INDICATORS AND GAGES

Made to meet the highest standards of precision performance for every quality control need.



HACKSAWS, HOLE SAWS, BAND SAWS AND BAND KNIVES

Precision made and production proved for top performance, uniformity and maximum cutting economy.

PRECISION GROUND DIE STOCK AND FLAT STOCK

Now over 1000 sizes — air, oil, oil and water and water hardening types. "Just lay it out and saw it out."

Starrett

SINCE 1880
WORLD'S GREATEST TOOLMAKERS

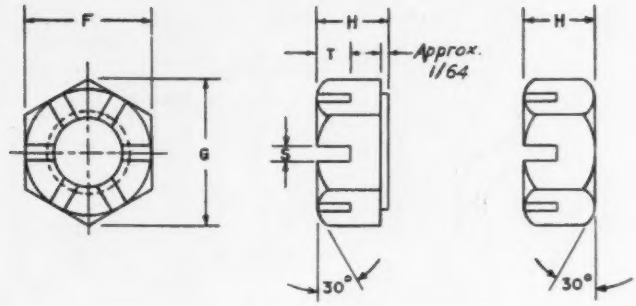
Buy THROUGH YOUR INDUSTRIAL DISTRIBUTOR
Prompt delivery
Dependable service
Quality products

MECHANICS' HAND MEASURING TOOLS AND PRECISION INSTRUMENTS
DIAL INDICATORS • STEEL TAPES • PRECISION GROUND FLAT STOCK
HACKSAWS • HOLE SAWS • BAND SAWS • BAND KNIVES

For more information fill in page number on Inquiry Card, on page 225

MACHINERY'S DATA SHEET

AMERICAN STANDARD FINISHED HEXAGON SLOTTED NUTS



Nominal Size or Basic Major Diameter of Thread	Width Across Flats F		Width Across Corners G		Thickness H			Slot	
	Max. (Basic)	Min.	Max.	Min.	Nom.	Max.	Min.	Width S	Depth T
1/4 0.2500	**7/16 0.4375**	**0.428**	**0.505**	**0.488**	**7/32**	**0.226**	**0.212**	0.078	0.094
5/16 0.3125	**1/2 0.5000**	**0.489**	**0.577**	**0.557**	**17/64**	**0.273**	**0.258**	0.094	0.094
3/8 0.3750	**9/16 0.5625**	**0.551**	**0.650**	**0.628**	**21/64**	**0.337**	**0.320**	0.125	0.125
7/16 0.4375	**11/16 0.6875**	**0.675**	**0.794**	**0.768**	**3/8**	**0.385**	**0.365**	0.125	0.156
1/2 0.5000	**3/4 0.7500**	**0.736**	**0.866**	**0.840**	**7/16**	**0.448**	**0.427**	0.156	0.156
9/16 0.5625	**7/8 0.8750**	**0.861**	**1.010**	**0.982**	**31/64**	**0.496**	**0.473**	0.156	0.188
5/8 0.6250	**15/16 0.9375**	**0.922**	**1.083**	**1.051**	**35/64**	**0.559**	**0.535**	0.188	0.219
3/4 0.7500	**1 1/8 1.1250**	**1.088**	**1.299**	**1.240**	**41/64**	**0.665**	**0.617**	0.188	0.250
7/8 0.8750	**1 5/16 1.3125**	**1.269**	**1.516**	**1.447**	**3/4**	**0.776**	**0.724**	0.188	0.250
1 1.0000	**1 1/2 1.5000**	**1.450**	**1.732**	**1.653**	**55/64**	**0.887**	**0.831**	0.250	0.281
1 1/8 1.1250	1 11/16 1.6875	1.631	1.949	1.859	31/32	0.999	0.939	0.250	0.344
1 1/4 1.2500	1 7/8 1.8750	1.812	2.165	2.066	1 1/16	1.094	1.030	0.312	0.375
1 3/8 1.3750	2 1/16 2.0625	1.994	2.382	2.273	1 11/64	1.206	1.138	0.312	0.375
1 1/2 1.5000	2 1/4 2.2500	2.175	2.598	2.480	1 9/32	1.317	1.245	0.375	0.438
1 3/4 1.7500	2 5/8 2.6250	2.538	3.031	2.893	1 1/2	1.540	1.460	0.438	0.500
2 2.0000	3 3.0000	2.900	3.464	3.306	1 23/32	1.763	1.675	0.438	0.562
2 1/4 2.2500	3 3/8 3.3750	3.262	3.897	3.719	1 59/64	1.970	1.874	0.438	0.562
2 1/2 2.5000	3 3/4 3.7500	3.625	4.330	4.133	2 9/64	2.193	2.089	0.562	0.688
2 3/4 2.7500	4 1/8 4.1250	3.988	4.763	4.546	2 23/64	2.415	2.303	0.562	0.688
3 3.0000	4 1/2 4.5000	4.350	5.196	4.959	2 37/64	2.638	2.518	0.625	0.750

All dimensions given in inches.

BOLD TYPE indicates products unified dimensionally with British and Canadian standards.

"Finished" in the title refers to the quality of manufacture and the closeness of tolerance and does not indicate that surfaces are completely machined.

Taper of the sides of nuts (angle between one side and the axis) shall not exceed 2 degrees, the specified width across flats being the largest dimension.

Tops of nuts shall be flat and chamfered. Diameter of top circle shall be the maximum width across flats within a tolerance of minus 15 per cent for washer-faced nuts and within a tolerance of minus 5 per cent for double-chamfered nuts.

Bearing surface shall be washer-faced or have chamfered corners. Diameter of washer face and the diameter of circle of bearing surface of double-chamfered nuts shall be the maximum width across flats within a tolerance of minus 5 per cent. Tapped hole shall be countersunk 1/64 inch over the major diameter of thread for nuts up to and including 1/2 inch, and countersunk 1/32 inch over the major diameter of thread for nuts over 1/2-inch size.

Bearing surface shall be at right angles to the axis of the threaded hole within a tolerance of 2 degrees for 5/8-inch nuts or smaller, and 1 degree for nuts larger than 5/8 inch; therefore, the maximum total runout of bearing face would equal the tangent of specified angle times the distance across flats.

Slots may have square or round bottoms at option of manufacturer.

Thread shall be coarse-, fine-, or 8-thread series; Class 2B.

Maximum width across corners equals 1.1547 times maximum width across flats.

Suitable material for steel nuts is covered by ASTM A-307; other materials will be agreed upon by manufacturer and user.

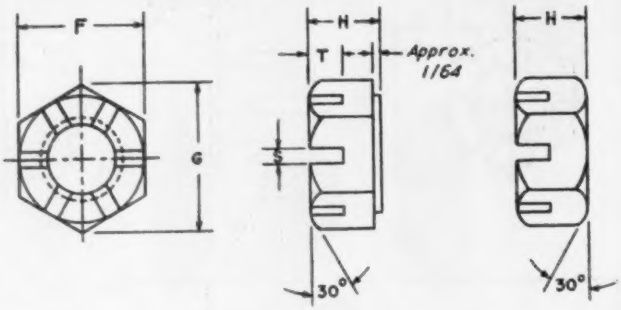
Tolerance on width across flats may be increased 0.015 inch for hot-formed nuts 5/8 inch and smaller.

Extracted from American Standard Square and Hexagon Bolts and Nuts (ASA B18.2-1955), with the permission of the publisher, the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.

MACHINERY'S DATA SHEET

AMERICAN STANDARD REGULAR SEMIFINISHED HEXAGON SLOTTED NUTS

1/4- to 5/8-inch sizes not recommended for new designs*



Nominal Size or Basic Major Diameter of Thread	Width Across Flats F		Width Across Corners G		Thickness H			Slot	
	Max. (Basic)	Min.	Max.	Min.	Nom.	Max.	Min.	Width S	Depth T
1/4 0.2500	7/16 0.4375	0.425	0.505	0.485	13/64	0.219	0.187	0.078	0.094
5/16 0.3125	9/16 0.5625	0.547	0.650	0.624	1/4	0.267	0.233	0.094	0.094
3/8 0.3750	5/8 0.6250	0.606	0.722	0.691	5/16	0.330	0.294	0.125	0.125
7/16 0.4375	3/4 0.7500	0.728	0.866	0.830	23/64	0.378	0.340	0.125	0.156
1/2 0.5000	13/16 0.8125	0.788	0.938	0.898	27/64	0.442	0.402	0.156	0.156
9/16 0.5625	7/8 0.8750	0.847	1.010	0.966	31/64	0.505	0.463	0.156	0.188
5/8 0.6250	1 1.0000	0.969	1.155	1.104	17/32	0.553	0.509	0.188	0.219
Below this line, dimensions are in accord with (Finished Hexagon Slotted Nut)									
3/4 0.7500	1 1/8 1.1250	1.088	1.299	1.240	41/64	0.665	0.617	0.188	0.250
7/8 0.8750	1 5/16 1.3125	1.269	1.516	1.447	3/4	0.776	0.724	0.188	0.250
1 1.0000	1 1/2 1.5000	1.450	1.732	1.653	55/64	0.887	0.831	0.250	0.281
1 1/8 1.1250	1 11/16 1.6875	1.631	1.949	1.859	31/32	0.999	0.939	0.250	0.344
1 1/4 1.2500	1 7/8 1.8750	1.812	2.165	2.066	1 1/16	1.094	1.030	0.312	0.375
1 3/8 1.3750	2 1/16 2.0625	1.994	2.382	2.273	1 11/64	1.206	1.138	0.312	0.375
1 1/2 1.5000	2 1/4 2.2500	2.175	2.598	2.480	1 9/32	1.317	1.245	0.375	0.438
1 5/8 1.6250	2 7/16 2.4375	2.356	2.815	2.686	1 25/64	1.429	1.353	0.375	0.438
1 3/4 1.7500	2 5/8 2.6250	2.538	3.031	2.893	1 1/2	1.540	1.460	0.438	0.500
1 7/8 1.8750	2 13/16 2.8125	2.719	3.248	3.100	1 39/64	1.651	1.567	0.438	0.562
2 2.0000	3 3.0000	2.900	3.464	3.306	1 23/32	1.763	1.675	0.438	0.562
2 1/4 2.2500	3 3/8 3.3750	3.262	3.897	3.719	1 59/64	1.970	1.874	0.438	0.562
2 1/2 2.5000	3 3/4 3.7500	3.625	4.330	4.133	2 9/64	2.193	2.089	0.562	0.688
2 3/4 2.7500	4 1/8 4.1250	3.988	4.763	4.546	2 23/64	2.415	2.303	0.562	0.688
3 3.0000	4 1/2 4.5000	4.350	5.196	4.959	2 37/64	2.638	2.518	0.625	0.750

* This table is published for interim use during the change-over to the new standard given in MACHINERY's Data Sheet for November 1956, page 258, until such time as complete conversion can be made.

All dimensions given in inches.

Semifinished nuts are finished on bearing surface and threaded.

Taper of the sides of nuts (angle between one side and the axis) shall not exceed 2 degrees, the specified width across flats being the largest dimension.

Tops of nuts shall be flat and chamfered. Diameter of top circle shall be the maximum width across flats within a tolerance of minus 15 per cent.

Bearing surface shall be washer-faced or have chamfered corners. Diameter of washer face shall be the maximum width across flats within a tolerance of minus 5 per cent.

Bearing surface shall be at right angles to the axis of the threaded hole within a tolerance of 2 degrees for 5/8-inch nuts or smaller and 1 degree for nuts larger than 5/8 inch; therefore, the maximum total runout of bearing face would equal the tangent of specified angle times the distance across flats.

Slots may have square or round bottoms at option of manufacturer.

Thread may be coarse-, fine-, or 8-thread series; Class 2B tolerance; unless otherwise specified, coarse-thread series will be furnished.

Suitable material for steel nuts is covered by ASTM A-307; other materials will be agreed upon by the manufacturer and the user.

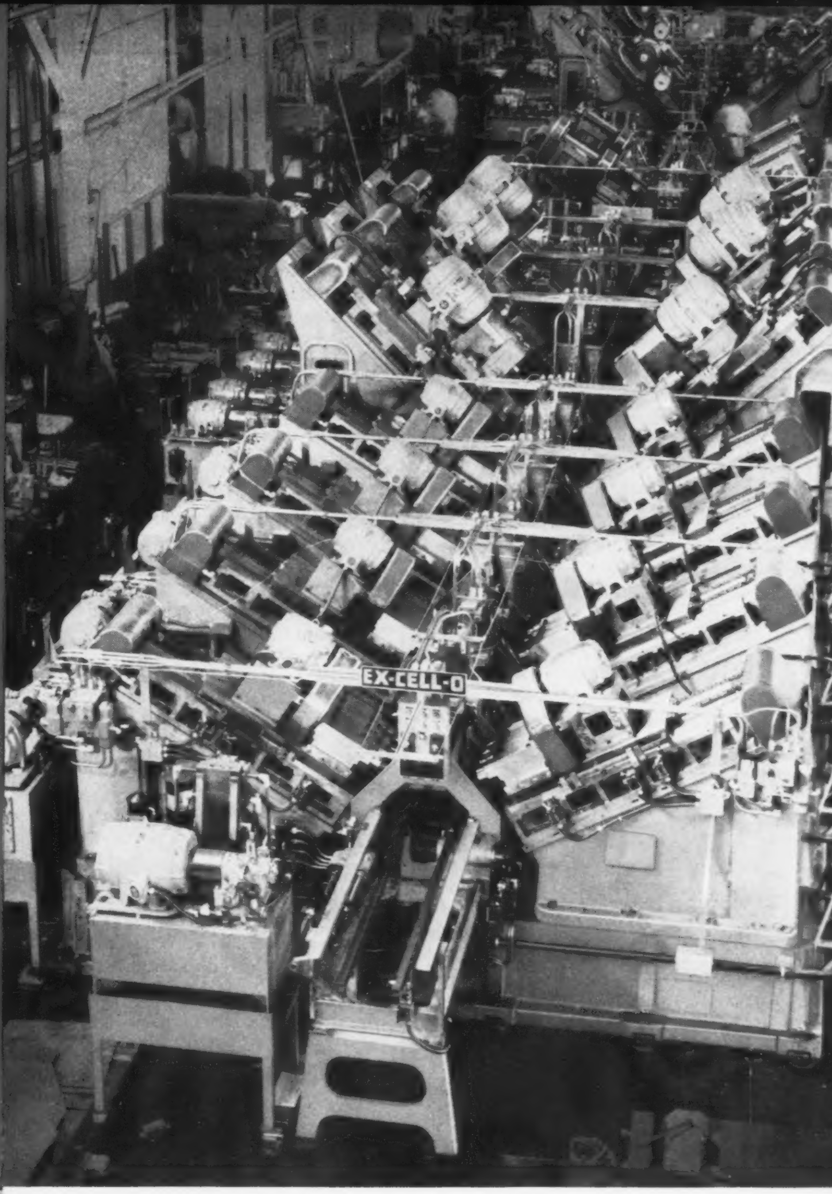
Extracted from American Standard Square and Hexagon Bolts and Nuts (ASA B18.2-1955), with the permission of the publisher, the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.

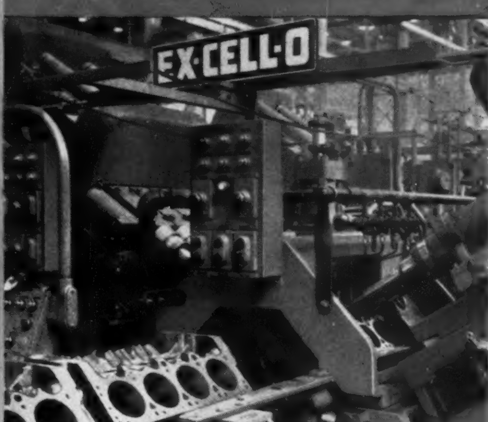
XLO

EX-CELL-O FOR PRECISION

3000 Engine Blocks Per Day –

How one company competes in the world's toughest market . . .





These Ex-Cell-O automation machines play an important part in turning out engine blocks for one of the "big three" of the automotive industry. This manufacturer's engine must compete in one of the toughest markets in the world.

Ex-Cell-O's part in the manufacturing process is 1200 feet of production line using the newest machines in assembled integrated units. Among the precision machining operations performed are boring, broaching, chamfering, milling, reaming and grooving.

Ex-Cell-O—builders of standard and special machine tools for 25 years—uses standard bases and subassemblies wherever possible. This means that product changes do not necessarily obsolete equipment. You save, too, in initial cost.

The photograph above is a view in the auto plant shortly after the automation line was installed. At right above, a portion of the line as it neared completion in the Ex-Cell-O plant.

EX-CELL-O
CORPORATION
DETROIT 32, MICHIGAN

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

56-43

Norton Co., Worcester, Mass., announces several new appointments following the establishment of three new divisions: Theodore J. Englund has been appointed manager of industrial engineering; Paul L. Lantz has been named assistant manager of industrial engineering; William F. Watts has been named to the new post of factory manager of the Refractories Division; and William P. Densmore has been appointed chief industrial engineer, another new position in the Refractories Division.

Raymond A. St. John has been appointed general sales manager of the Heald Machine Co., Worcester, Mass. Mr. St. John was formerly manager of the company's Detroit branch sales office. He has been with the company thirty-seven years.

Walter R. Bush has been appointed vice-president in charge of engineering and a member of the management committee of Fenwal, Inc., Ashland, Mass.

Market Forge Co., Everett, Mass., announces the sale of its Materials Handling Division to the American Pulley Co., Philadelphia, Pa.

Allen W. Rockwell has been elected vice-president in charge of the Waterbury Division of the American Brass Co., Waterbury, Conn. He succeeds Ralph T. Benedict, who retired after fifty-two years' service. Mr. Rockwell has been with the company since 1935. In 1938, he joined the division's personnel and employment office and was later appointed labor supervisor.

Allen W. Rockwell, newly elected vice-president, Waterbury Division of American Brass Co.

From 1946 to 1953 Mr. Rockwell was division works manager. He was made manager of the division three years ago.

Heli-Coil Corporation, Danbury, Conn., announces the appointment of four executives in the Sales Division—John E. Fasano has been named sales manager; Bayeux B. Morgan, Jr., assistant sales manager; Robert H. Kane, advertising manager; and J. Laurence Sutton, manager of customer service.

Roland J. Ahern was elected president and general manager of the Peck, Stow & Wilcox Co., Southington, Conn. Mr. Ahern has been president and general manager of the parent company, Billings & Spencer Co., Hartford, Conn., since 1944 and will continue in that capacity.

James H. Broderick was appointed sales manager for the Geometric Tool Co., division of Greenfield Tap & Die Corporation, New Haven, Conn. Mr. Broderick has been with the company since 1935 and has been acting field sales manager since 1949.

Waterbury Farrel Foundry & Machine Co., Waterbury, Conn., announces the following appointments: Fred S. Van Valkenburg has been elected chairman of the board, and A. Dale Mitchell was elected president.

Samuel P. Caldwell has been named to the newly created position of director of research and development of the Greist Mfg. Co., New Haven, Conn.

Charles W. Wesson has been appointed general manager of the Eastern Machine Screw Corporation, New Haven, Conn.

Reginald C. Morrell has been appointed market research manager for Associated Spring Corporation, Bristol, Conn.

William H. Mann has been promoted to sales manager of the Skinner Electric Valve Division, Skinner Chuck Co., New Britain, Conn.

Ohio

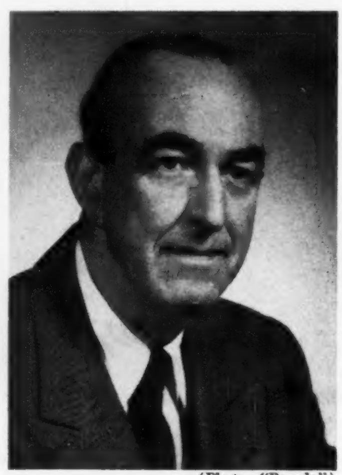
R. K. LeBlond Machine Tool Co., Cincinnati, Ohio, announces the purchase of the Fosdick Machine Tool Co. of the same city. Concurrently, it was announced that Carl E. Linden, Fosdick's general manager for over twenty-three years, has been appointed president and general manager of the Fosdick firm.

W. H. Bennett, president, Hydraulic Press Mfg. Co.

W. H. Bennett has been elected president of the Hydraulic Press Mfg. Co., Mount Gilead, Ohio, a division of Koehring Co. Mr. Bennett, who has been associated with H-P-M since 1939, has served as manager of the metalworking press division, assistant general sales manager, director of engineering, and vice-president in charge of sales.

Dr. James C. Hodge, vice-president of Warner & Swasey Co., Cleveland, Ohio, was elected executive vice-president and director of the company. The office of executive vice-president has been vacant since the death of L. D. McDonald in 1954. As director, Dr. Hodge succeeds Warren J. Henderson, who resigned last week.

(This section continued on page 250)



(Photo, "Parade")

Dr. James C. Hodge, executive vice-president and director of Warner & Swasey Co.

PHILIP O. GEIER, JR., has been appointed to the new position of assistant manager and HAROLD W. COTTRELL to sales manager of the Cincinnati Milling Products Division, Cincinnati Milling & Grinding Machines, Inc., Cincinnati, Ohio. Mr. Geier, who has been sales manager for the past two years, has been with the company for seventeen years. Mr. Cottrell became associated with the company in 1936.

EDWARD E. HELM has been elected president of the Reliance Electric & Engineering Co., Cleveland, Ohio. Mr. Helm, who has served as vice-president and general manager of the company, joined Reliance in 1924.

LOWE BROTHERS Co., Dayton, Ohio, announces the following appointments: PAUL H. HARN, vice-president and secretary; EDGAR W. FASIG, vice-president of manufacturing; and WILLIAM C. RHODES, vice-president of sales.

J. P. ARNDT, JR., has been appointed assistant to the vice-president and general sales manager of Brush Electronics Co., division of Clevite Corporation, Cleveland, Ohio.

ROBERT A. BECK has been appointed vice-president of City Tool Corporation, Dayton, Ohio. Mr. Beck is also plant superintendent.

JAMES E. BARKER has been appointed assistant sales manager of the Copeland Refrigeration Corporation, Sidney, Ohio.

R. H. CULLEN has been appointed abrasive engineer of the Sterling Grinding Wheel Co., Tiffin, Ohio.

CHEDO P. GRAHAM has been promoted to chief engineer of the Aro Equipment Corporation, Bryan, Ohio.

FRANCIS P. BLONSKA has been appointed administrative assistant in sales for the Cleveland Cap Screw Co., Cleveland, Ohio.

FRANK J. SMITH has been elected a vice-president of the Columbus Bolt & Forging Co., Columbus, Ohio.

Pennsylvania and Delaware

THEODORE W. BOSSERT has been appointed chief metallurgist of the Aluminum Company of America, Pittsburgh, Pa. Mr. Bossert has been serving as assistant chief metallurgist of the metal manufacturing division since 1951.

Joseph L. Kane, vice-president of Kennametal, Inc.

JOSEPH L. KANE, Rear Admiral, U.S.N., retired, was elected vice-president of Kennametal, Inc., Latrobe, Pa. In addition to participating actively in planning the company's current expansion program, Admiral Kane will be concerned with administration and will serve as coordinator of the company's activities with government defense agencies.

LANDIS TOOL Co., Waynesboro, Pa., announces the following appointments: J. J. KEANE was named assistant general sales manager and R. E. PRICE, vice-president and assistant general manager. Mr. Price has been with the company for twenty-seven years. Mr. Keane has been with the company since 1927 and was formerly manager of the Detroit office.

ANTHONY J. SNYDER has been appointed assistant to the vice-president of sales at Firth Sterling, Inc., Pittsburgh, Pa. Mr. Snyder was formerly vice-president and general manager of the Morse Twist Drill & Machine Co., New Bedford, Mass.

CRUCIBLE STEEL COMPANY OF AMERICA, Pittsburgh, Pa., announces the acquisition of the entire interests of National Research Corporation in Vacuum Metals Corporation, which now becomes a wholly owned Crucible subsidiary.

GEORGE M. CHANDLER has been named sales manager of the Carmet Division of Allegheny Ludlum Steel Corporation, Pittsburgh, Pa. Mr. Chandler replaces PAUL F. REHNER, who will be on special assignment for the corporation.

HARVEY W. SEYMOUR has been appointed to the newly created position of general manager of the Page Steel and Wire Division, American Chain & Cable Co., Inc., Monessen, Pa. Mr. Seymour has been with the company since 1926.

CLYDE R. DEAN, JR., director of export sales, Yale Materials Handling Division, Yale & Towne Mfg. Co., Philadelphia, Pa., has been promoted to general sales manager.

WILLIAM L. VAN WINKLE has been appointed steel mill roll sales representative in the Pittsburgh area by the Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.

R. A. WILLSON has been appointed district manager of the New York and New England territories for the Wright Hoist Division, American Chain & Cable Co., Inc., York, Pa.

KENNETH G. HUNT has been appointed superintendent of construction and shops for the Crucible Steel Company of America's Midland, Pa., works.

ROBERT C. LINDBERG has been appointed production manager of Firth-Loach Metals, Inc., McKeesport, Pa.

ROY S. FISHER was elected vice-president and named director of sales for National Vulcanized Fibre Co., Wilmington, Del. In his new capacity, he will direct the sales of the company's industrial and consumer products to both domestic and overseas markets.

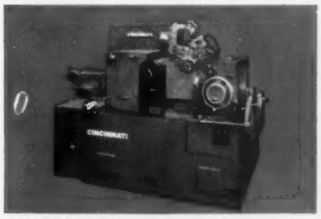
Wisconsin and Minnesota

GARDNER MACHINE Co., Beloit, Wis., a wholly owned subsidiary of the Landis Tool Co., announces the following appointments: VERNON L. LOOFBORO has been appointed general manager; JOHN MOURER, assistant general manager; WILLIAM KISSINGER, plant manager; JOHN McLAUGHLIN, machine shop superintendent; and PHILIP ALLEN, assistant manager of the abrasive department.

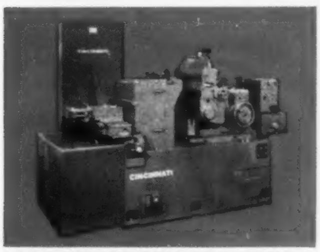
KEARNEY & TRECKER CORPORATION, Milwaukee, Wis., announces two executive appointments and the assignment of a new dealer representative. JOHN BURG, former New York manager, was named eastern district manager, and ALFRED HOSTVEDT was appointed Mr. Burg's successor in New York. THE SYRACUSE SUPPLY Co. was appointed to represent Kearney & Trecker in the Buffalo, Syracuse, and Rochester areas.

(This section continued on page 252)

CINCINNATI® FILMATIC No. 0 Centerless Grinder. 5 hp spindle drive, 0 to ½" diameter capacity. Catalog No. G-640-1.



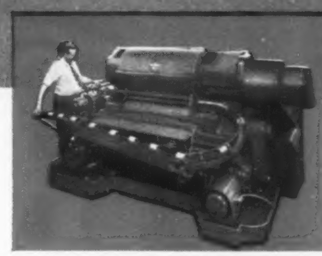
CINCINNATI® FILMATIC No. 2 Centerless Grinder. 15 hp spindle drive, 1/16" to 4¾" diameter capacity. Catalog No. G-644-2.



CINCINNATI® FILMATIC No. 3 Centerless Grinder. 25 hp spindle drive, ½" to 6" diameter capacity. Catalog No. G-664-1.

There's a size in the CINCINNATI Centerless line to suit your needs

CINCINNATI® FILMATIC No 4 Centerless Grinder. 30 hp spindle drive, ½" to 9" diameter capacity. Catalog No. G-538-3.

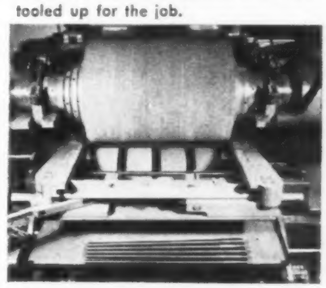


Pistons take a round trip through this **CINCINNATI® FILMATIC No. 5 Centerless Grinder** to get an extra fine finish and close tolerance sizing. The No. 5's (up to 75 hp spindle drive) are tooled up for the job.

Centerless is a versatile process of precision grinding. Railroad car wheel axles, billiard balls, synthetic sapphire, carbon sticks, 32" long gun barrels . . . all are ground at much lower cost on Cincinnatis than by any other method known today. And for these diverse parts, and thousands in between, it requires **a line** of Centerless Grinders.

Cincinnati builds the only complete line of centerless grinders, from 5 hp to 75 hp spindle drive. Cincinnati offers the only Engineering Service experience in centerless grinding extending over 30 years.

CINCINNATI Centerless is versatile, and variety of applications are still growing. May we help you reduce the cost of your precision grinding operations? Send blueprints and complete details, or if you handle your own tooling, write for catalogs on the machines in which you are interested. You will find brief specs in Sweet's.



Shotgun barrels receive a uniform lustre their entire length, comprising five tapers and a straight section, by grinding them on this **CINCINNATI® FILMATIC No. 6 Centerless Grinder.** The No. 6's (up to 75 hp spindle drive) are tooled up for the job.

CINCINNATI

CINCINNATI GRINDERS INCORPORATED
CINCINNATI 9, OHIO

CENTERTYPE GRINDING MACHINES • CENTERLESS GRINDING MACHINES • ROLL GRINDING MACHINES • SURFACE GRINDING MACHINES • CHUCKING GRINDERS • MICRO-CENTRIC GRINDING MACHINES • CENTERLESS LAPPING MACHINES

For more information fill in page number on Inquiry Card, on page 225

John M. Dolan, vice-president and general manager of field sales, Giddings & Lewis Machine Tool Co.

JOHN M. DOLAN has been appointed vice-president and general manager of the field sales division of Giddings & Lewis Machine Tool Co., Fond du Lac, Wis. Mr. Dolan was formerly with Solar Aircraft Co., San Diego, Calif., as vice-president of sales and manager of proprietary and commercial products. He also served as general sales manager of the LeRoi Co., Milwaukee, Wis., and later as vice-president—sales. Mr. Dolan became a part of the machine tool industry in 1949, when he was appointed vice-president of sales of the Hydraulic Press Mfg. Co., Mt. Gilead, Ohio, later becoming a director of that company.

JAMES MACCRACKEN ADAIR has been appointed sales manager of the Dynamatic Division of the Eaton Mfg. Co., Kenosha, Wis.

EDWIN B. OLSON has been appointed manager of market planning at Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

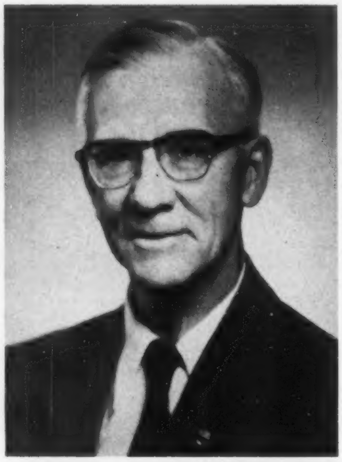
Obituaries

John E. Poorman

JOHN E. POORMAN, president and founder of J. E. POORMAN, INC., Philadelphia, Pa., manufacturers and distributors of R and L tools, died on October 3 at the age of eighty-five years. During his lifetime, Mr. Poorman established a reputation as a perfectionist of his trade, and the R and L tools which he invented have received world-wide acceptance and acclaim.

Douglas T. Hamilton

DOUGLAS T. HAMILTON, retired publicity manager for the Fellows Gear Shaper Co., Springfield, Vt., died on September 26 at the age of seventy-one years. Mr. Hamilton, who was born in Edina, Quebec, Canada, came to the United States in 1910 and became a naturalized citizen in 1918. For a number of years he was located in New York as an associate editor of MACHINERY.



He wrote several books on mechanical and technical developments during that time and was a recognized authority on the manufacture of rifles. In 1917, he became advertising manager and later publicity manager for Fellows Gear Shaper Co. and remained in that capacity until his retirement in 1952. He was an active member of the American Gear Manufacturers' Association and a member of a number of committees of that organization.

HAROLD E. STAVERS, sales manager for the Detroit plant of Joseph T. Ryerson & Son, Inc., Chicago, Ill., died on October 21 at the age of sixty-three years. Mr. Stavers began his career with Ryerson in 1913 at the company's Chicago plant. In 1919 he was transferred to Detroit and, in 1923, appointed sales representative. He remained in that capacity until his promotion to sales manager in 1955.

E. R. WAGNER, founder of the E. R. Wagner Mfg. Co., Milwaukee, Wis., died on November 4. He was president of the business until November 1953, when he became chairman of the board and turned over the presidency and active control of the business to his son, Robert S. Wagner.

New Books

MECHANICAL VIBRATIONS. By J. P. Den Hartog. 436 pages, 6 by 9 inches. Fourth Edition. Published by McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36, N. Y. Price, $9.

While dealing with vibration phenomena in a thoroughly technical manner, this book emphasizes the many applications of principles and calculations of principles and calculations to the practical vibration problems encountered by the practicing engineer. Complete explanations and proofs are given in simple mathematics.

Changes and additions in this publication are as follows: New material has been added on Karman vortices and nonlinear vibrations, with examples of cases that have been appearing in practice since 1947. The number of problems has been increased substantially. Changes have been made in every chapter to bring the subject up to date. In order to keep the size of the volume within bounds, these changes consist of deletions as well as additions.

METALLURGY. By Carl G. Johnson. 432 pages, 6 by 9 inches. Fourth edition. Published by the American Technical Society, 848 E. 58th St., Chicago, Ill. Price, $5.50.

This practical survey work is concerned primarily with physical metallurgy—dealing with the physical and chemical behavior of metals during shaping and treating operations. The selection and application of metals in modern industry is discussed at length.

This edition includes an entirely new chapter on the recently developed metals titanium, zirconium, indium, and vanadium; methods of production, physical and mechanical properties; and uses of these additions to the family of engineering metals have been treated with clarity and thoroughness.

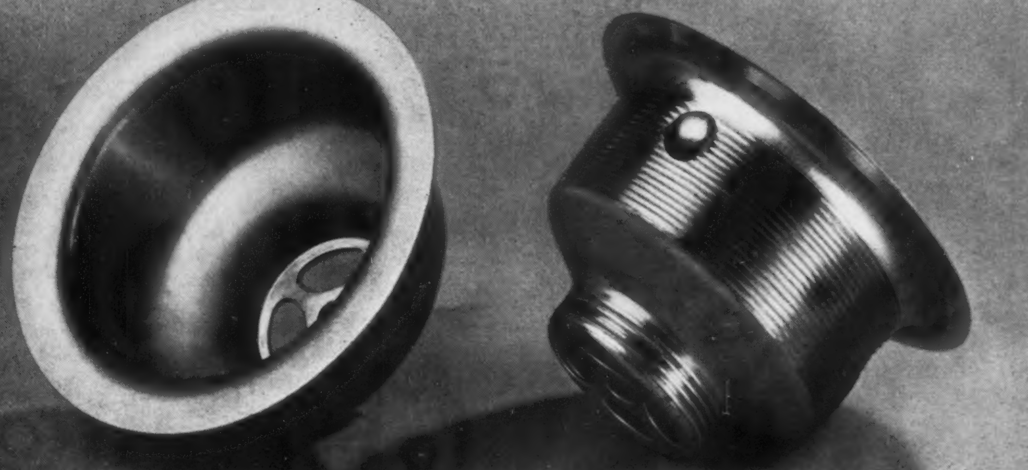
° ° °

Annual Index to MACHINERY

The annual index to Volume 62 of MACHINERY (September 1955 to August 1956, inclusive) is now ready for distribution. Subscribers who have not previously requested copies can obtain them without charge by writing to MACHINERY, Circulation Department, 93 Worth St., New York 13, N. Y.

2,500,000

sink strainers couldn't be wrong



Strainer is made [illegible] .065" gauge x 7" Revere Leaded Brass Strip drawn to a depth of 2½".

MICHIGAN BRASS Company saw to that by using REVERE Leaded Brass Strip

Michigan Brass has a reputation for making only quality plumbing goods. So the material for their sink strainers had to be good to start with and remain consistently so over the years. After making over two and a half million strainers from Revere Leaded Brass Strip they tell us that not only has their quality for this item been consistent, but they also have realized certain savings in production.

Here's why they use Revere Leaded Brass for their strainers:

1. The inherent corrosion resistance of brass. 2. Its deep drawing characteristics (Photo at left above shows strainer after it has been blanked and drawn in progressive die). 3. Ease of machining large diameter threads with leaded brass. 4. The excellent surface that can be developed for chrome plating (Photo above right shows strainer after it has been trimmed, dimpled, threaded and plated). 5. The consistent uniformity and quality of Revere Leaded Brass Strip over the years.

These very same characteristics of Revere Leaded Brass Strip may be the very ones that could help you retain the quality of your product over the years . . . cut your production costs. Why not have a chat with a Revere TA (Technical Advisor) and see? It costs you nothing . . . may save you plenty.

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REVERE COPPER AND BRASS INCORPORATED
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230 Park Avenue, New York 17, N. Y.
Mills: Baltimore, Md.; Brooklyn, N. Y.; Chicago, Clinton and Joliet, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Newport, Ark.; Rome, N. Y. Sales Offices in Principal Cities, Distributors Everywhere.

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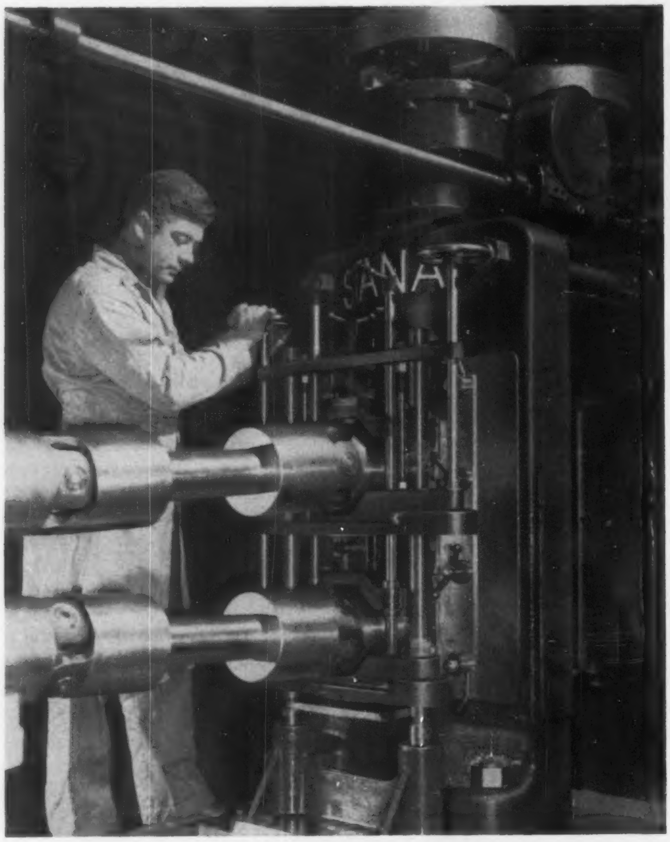


View of spindle cradle of Stanat mill (before installation at Argonne National Laboratory)

Rolling Plutonium Inside a Plastic Hood

Plutonium is being processed on two rolling mills which are enclosed in airtight plastic hoods at the Argonne National Laboratory, Lemont, Ill. Molded into the hoods at 2-foot intervals are neoprene glove ports through which necessary manipulations of the work and equipment can be made without exposure to the deadly gamma dust. A pressurized helium atmosphere within the hoods discourages any seepage of air. The mills, one of which will be used for instructional purposes, were engineered and built by the Stanat Mfg. Co., Westbury, N. Y.

Each mill is a combination two-high and four-high roll arrangement. Work rolls are 2 1/2 inches in diameter, and backup rolls, 10 inches. A 50-H.P. motor drives the mill through a speed reducer and pinion stand, with a rolling load capacity of 600,000 pounds, at a speed of 100 feet per minute. Roll adjustment is through a power screw-down system having a variable-speed gear-motor.

One of the features of the equipment is a power-operated mechanism which facilitates removal and replacement of the rolls. Universal-joint spindles connecting the backup rolls to the pinion stand are equipped with a cradle to maintain their position while the roll assemblies are withdrawn from the mill housing.

STATEMENT REQUIRED BY THE ACT OF AUGUST 24, 1912, AS AMENDED BY THE ACTS OF MARCH 3, 1933, AND JULY 2, 1946 (TITLE 39, UNITED STATES CODE, SECTION 233) SHOWING THE OWNERSHIP AND MANAGEMENT

of MACHINERY, published monthly at Bristol, Conn., for October 1, 1956.

1. The names and addresses of the publisher, editors, managing editor, and business managers are: Publisher, The Industrial Press, 93 Worth St., New York 13, N. Y.; Editor, Charles O. Herb; Consulting Editor, Franklin D. Jones; Business Managers, Robert B. Luchars, Edgar A. Becker, and Harold L. Gray. The address of all the foregoing is 93 Worth St., New York 13, N. Y.

2. The owners of 1 per cent or more of the total amount of stock are: The Industrial Press, Robert B. Luchars, Edgar A. Becker, Franklin D. Jones, Walter E. Robinson, Charles O. Herb, Harold L. Gray, Clifford Strock, and Suno E. Larson, all of 93 Worth St., New York 13, N. Y.; Helena E. Oberg, 65 Eighty-second St., Brooklyn 9, N. Y.; Edgar L. Becker, Nominee for Nancy Jane Becker, Susan Louise Becker, and Donald Louis Becker, 714 Wellington Road, Ridgewood, N. J.; First National Bank of Montclair and Robert B. Luchars, Trustees (Beneficiaries unknown), Upper Montclair, N. J.; First National Bank of Montclair and Leigh Roy Urban, Trustees (Beneficiaries unknown), Upper Montclair, N. J.; First National Bank of Montclair and Kenneth D. Ketchum, Trustees (Beneficiaries unknown), Upper Montclair, N. J.; David D. Ketchum, 38 Mill Road, Falmouth, Mass.; Lee W. Noyes, Guardian for Susan Yarnell Urban, Greensboro, Vt.; Lee W. Noyes, Trustee under the Will of Robert L. Urban, Greensboro, Vt.; and John T. Urban, 8 Craigie Circle, Cambridge 38, Mass.

3. The known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: Charlotte B. Baldwin, 420 Clinton Ave., Brooklyn, N. Y.; Robert B. Luchars and Franklin D. Jones, both of 93 Worth St., New York 13, N. Y.; Ann Pelletier, 140 Cabrini Blvd., New York 33, N. Y.; Elizabeth Y. Urban, 38 Lakeview Road, Asheville, N. C.; Helen L. Ketchum, 231 King St., Cohasset, Mass.; Wilbert A. Mitchell, 28 Harlow Road, Springfield, Vt.; and Henry V. Oberg, 6825 Almansa St., Coral Gables, Fla.

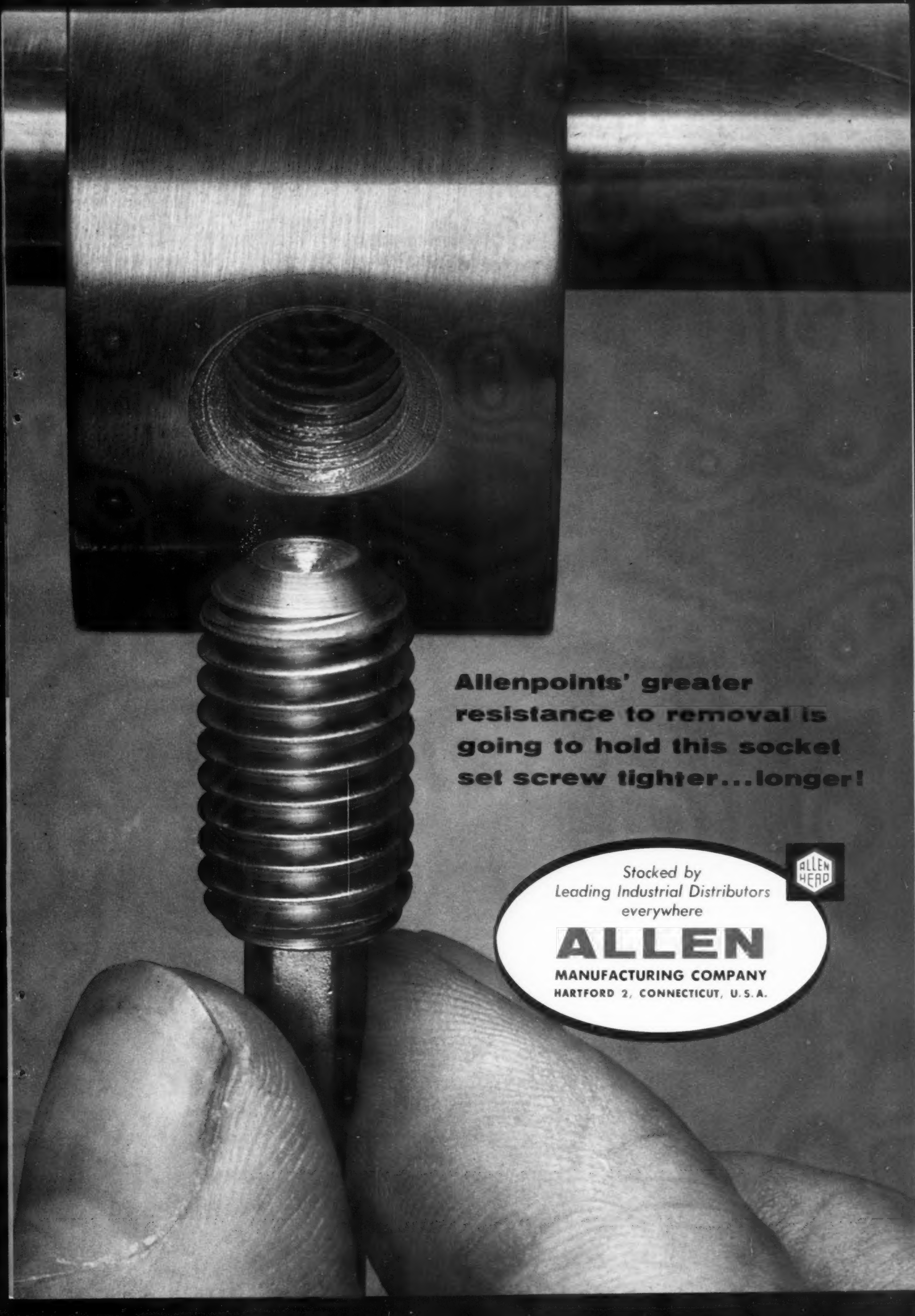
4. Paragraphs 2 and 3 include, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting; also the statements in the two paragraphs show the affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner.

EDGAR A. BECKER, Business Manager

Sworn to and subscribed before me this 21st day of September, 1956. (SEAL).

ALEXANDER LOYKA

Notary Public, State of New York
No. 31-7611350
Qualified in New York County
Commission Expires March 30, 1958


Allenpoints' greater resistance to removal is going to hold this socket set screw tighter...longer!
Stocked by Leading Industrial Distributors everywhere
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Jacobs and your industrial supply distributor are ready to deliver the chucks you need and the service you deserve. First in chucks . . . first in service.
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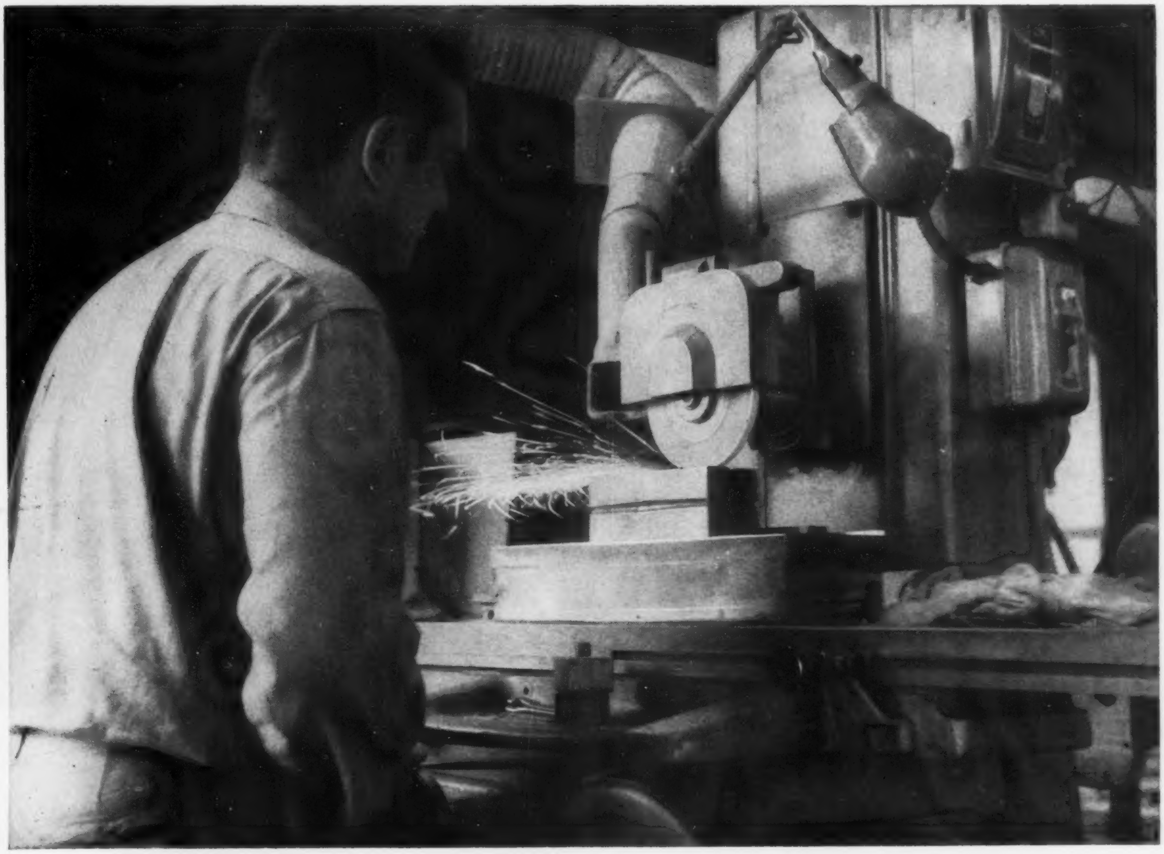


"5 years ago Cities Service solved all our lubrication problems and we've never had another!"

A report from Banner Spring & 4 Slide Co., Van Dyke, Michigan

These Were The Problems 5 Years Ago: Banner Spring & 4 Slide Company, maker of small parts for the automobile, electrical and refrigeration industries, was having trouble. Ways, bearings, and drive shafts on 4 Slide machines were getting insufficient film strength from lubricants and constantly burning out. Likewise, compressors were also running hot, and there was complete puzzlement over what type of lubricant to use for Banner's high-speed sewing machines.

Banner decided to call in a Cities Service Lubrication Engineer. A thorough survey followed, with the man from Cities Service carefully examining each machine and its particular operating conditions.

This completed, he made his recommendations — Trojan H-2 Multi Purpose Grease for the 4 Slide machines, Pacemaker No. 1 Oil for the compressors, and Pacemaker 00 Oil for the high-speed sewing machines.

Banner followed these recommendations to the letter. Result: Not one lubrication problem in the past five years — despite the fact that machinery runs 24 hours a day!

If you're faced with a lubrication problem — or if you're just not sure if your present lubricant is best for the job — talk with the man from Cities Service. Or write: Cities Service Oil Company, Sixty Wall Tower, New York 5, N. Y.

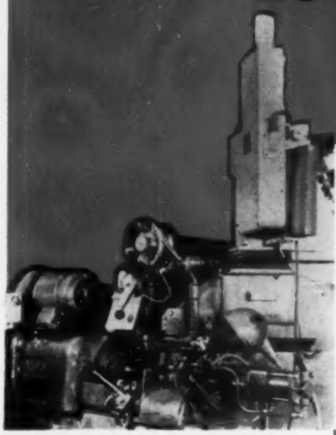
SOME BANNER PRODUCTS: The firm makes all kinds of round wire forms, wire springs, metal clips and flat springs. Use for such products ranges from auto fender support rods to "burlap listings"— the wire frames sewn into burlap which back up automobile upholstery.

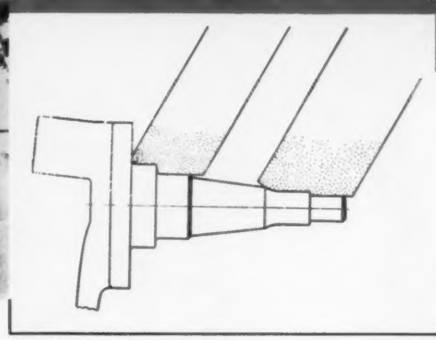
CITIES SERVICE

QUALITY PETROLEUM PRODUCTS

GRINDING WHEEL PROFILES never before possible

ON CYLINDRICAL GRINDERS





with the new

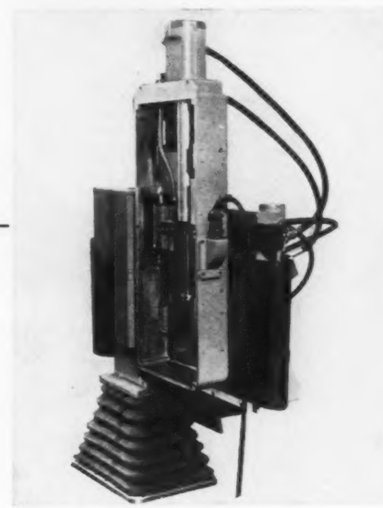
HOGLUND

Model 86

CONTOUR WHEEL DRESSER

THE DRESSER WITH ENLARGED SYNCHRONIZED TEMPLATES

Now, with the Model 86, any complex contour can be formed on the grinding wheel, limited only by the size and shape of the Diamond. If the Diamond can enter into the profile, the profile can be dressed —in fact, any contour desired can be continuously and accurately dressed in one automatic cycle! Instead of single template bars, Model 86 uses a pair of enlarged synchronized templates to obtain the most complex contours. Model 86 insures absolutely UNIFORM peripheral contour movements—giving profiles heretofore considered impossible on Cylindrical grinders. Here is perfect contour grinding accuracy through correct dressing of abrasive wheels, the HOGLUND way of practically eliminating skill in production contour grinding.



Check these features of HOGLUND CONTOUR WHEEL DRESSERS

Precision

Automaticity

Will dress any angle on the grinding wheel, perpendicular as well as horizontal.

Not limited to shallow angles and profiles but will dress any angle up to perpendicular to the grinding spindle can even undercut grinding wheels, if necessary).

Eliminates necessity of skill in contour grinding.

Set up time negligible. No skill required.

Diamonds optically set in Microscope. No adjustment required on machine when changing diamonds, so repetition within a tenth is possible.

Uniform peripheral dressing speed of diamond.

HOGLUND FOR ACCURACY

HOGLUND

341 Snyder Ave., Berkeley Heights, N. J.

ENGINEERING & MANUFACTURING CO.

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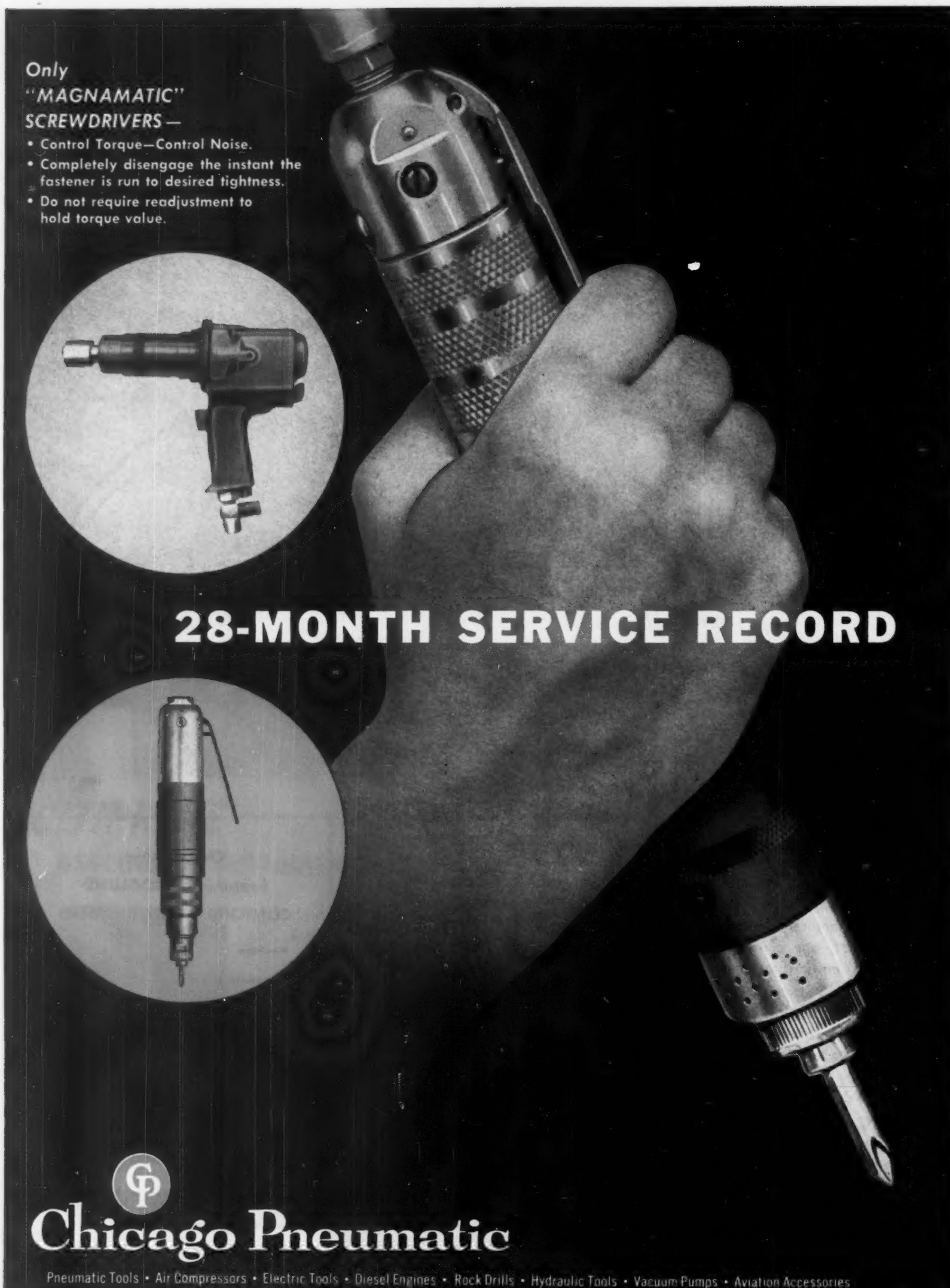
Only
"MAGNAMATIC"
SCREWDRIVERS—
• Control Torque—Control Noise.
• Completely disengage the instant the fastener is run to desired tightness.
• Do not require readjustment to hold torque value.
28-MONTH SERVICE RECORD
Chicago Pneumatic
Pneumatic Tools • Air Compressors • Electric Tools • Diesel Engines • Rock Drills • Hydraulic Tools • Vacuum Pumps • Aviation Accessories

TESTED BY TIME —ON THE LINE!

PROVES "MAGNAMATIC" IS...

FIRST in reducing work spoilage

FIRST to eliminate clutch buzz that adds to tool maintenance

FIRST to overcome exhaust noise

Air-driven "Magnamatic" is the *only* Controlled-Torque screwdriver-nutrunner to prove itself in over two years of "on the line" service. In hundreds of applications, Magnamatic "One-Shot" Screwdrivers are used where proper tightness is all-important in eliminating stripped threads, sheared fasteners, damaged parts. Tell us your fastener problem. There are 13 models of "Magnamatic" to help you step up production and reduce fastening costs.

Capacities: #4 screws to 3/8" bolts.

Reversible and non-reversible types

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8 East 44th Street, New York 17, N. Y.

☐ Please send me FREE booklet SP-3165 "Magnamatic Case Histories."

☐ Please send me "Magnamatic" Bulletin SP-3126.

☐ Have representative call.

Name__________ Title__________

Company__________

Address__________

City__________ Zone_____ State__________

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Product Directory

To find headings easily, look for capital letters at top of each page to denote location.

ABRASIVE CLOTH, Paper and Belt
Crane Packing Co., Morton Grove, Ill.

ABRASIVES, Discs
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Gardner Machine Co., Beloit, Wis.
Norton Co., 1 New Bond St., Worcester, Mass.
Simonds Abrasive Co., Tacony and Fraley Sts., Bridesburg, Philadelphia, Pa.

ABRASIVES, Polishing, Tumbling, Etc.
Crane Packing Co., Morton Grove. Ill.
Cratex Manufacturing Co., 81 Natoma St., San Francisco, Calif.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Simonds Abrasive Co., Tacony and Fraley Sts., Bridesburg, Philadelphia, Pa.

ACCUMULATORS, Hydraulic
Erie Foundry Co., 1253 W. 12th St., Erie, Pa.
Farrel-Birmingham Co., Inc., Ansonia, Conn.

AIR GAGES, Dimensional—See Gages Air Comparator

AIR GUNS
Chicago Pneumatic Tool Co., New York 17, N. Y.
Schrader's Sons, A., 470 Vanderbilt Ave., Brooklyn 38, N. Y.

AIR TOOLS—See Grinders, Portable, Pneumatic Drills, Portable, Pneumatic, Etc.

ALLOY STEELS
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Columbia Tool Steel Co., Chicago Hts., Ill.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., Carnegie-Illinois Steel Corp. Div., 436 7th Ave., Pittsburgh, Pa.
Vanadium Alloys Steel Co., Latrobe, Pa
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

ALLOYS, Bearing
Bunting Brass & Bronze Co., 715 Spencer, Toledo 1, Ohio.
Carpenter Steel Co., 105 W. Bern St., Reading, Pa.
Crucible Steel Co. of America, Henry W. Oliver Bldg., Mellon Square, Pittsburgh 22, Pa.
Mueller Brass Co., Port Huron, Mich.

ALLOYS, Non-ferrous—See Brass, Copper, Zinc and Stellite

ALUMINUM and Aluminum Products
Bridgeport Brass Co., Bridgeport, Conn.
Mueller Brass Co., Port Huron, Mich.
Revere Copper & Brass, Inc., 230 Park Ave., New York 17, N. Y.
Ryerson & Son, Jos. T., 16th & Rockwell Sts. Chicago 8, Ill.

ANGLE PLATES—See Set-Up Equipment

ANNEALING FURNACES
Eisler Engrg. Co., 750 So. 13th St., Newark 3, N. J.
General Electric Co., Schenectady, N. Y.

ARBOR PRESSES—See Presses Arbor

ARBORS AND MANDRELS
Brown & Sharpe Mfg. Co., Providence, R. I.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Jacobs Mfg. Co., West Hartford, Conn.
Kearney & Trecker Corp., Milwaukee 14, Wis.
Logansport Mch. Co., Inc., Logansport, Ind.
South Bend Lathe Wks., South Bend 22, Ind.
Supreme Products, Inc., 2222 So. Calumet Ave., Chicago 16, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

(Continued on page 264)

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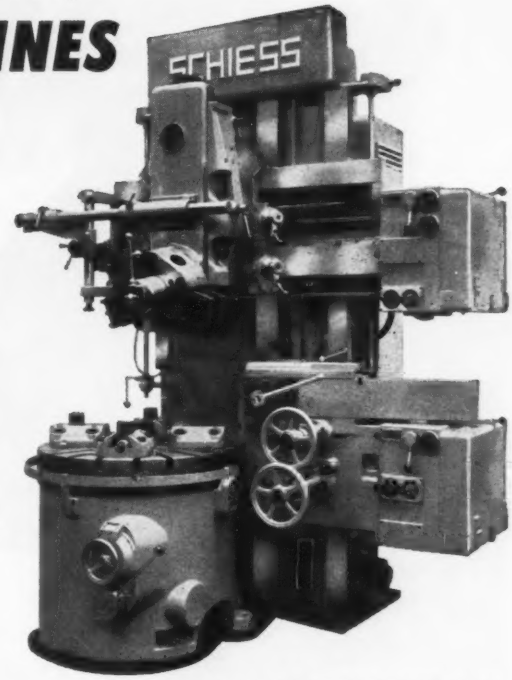
See why Tool Engineers call these heavy producers,

"MOST MODERN MACHINES OF THEIR TYPE"



Model KE Single Column Vertical Turret Lathes with 40", 50" and 65" turning diameters for high-speed carbide machining.

Hydraulic pre-selection of speeds set by handwheel and read on illuminated dial. 16 spindle speeds—ratio 1:50—up to 310 rpm for carbide machining on Model KE 100. Table runs on tapered roller bearings.

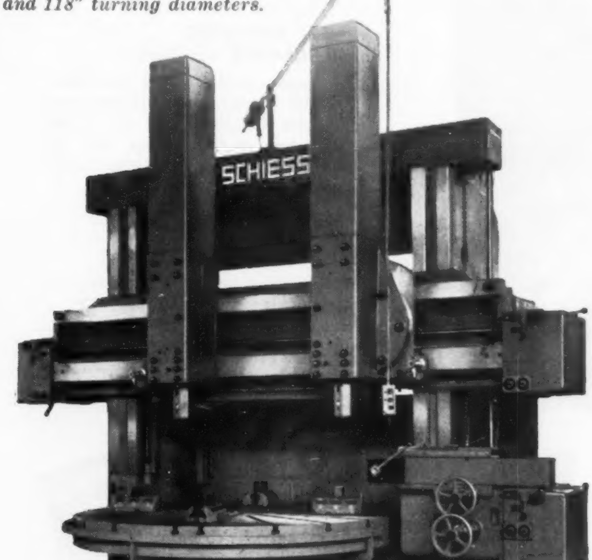
Fingertip control for direction of feed and rapid traverse with spring-loaded mono-levers for normal direction plus angular compound feeds. Mono-levers move in same direction as desired feed or traverse movement, simplify correct setting by operator. Specially designed electro-magnetic disc clutches disengage feed instantly with no over-riding or coasting.

Counterbalanced cross rail and side head. Single lever unlocks, raises or lowers, and locks cross rail simultaneously by electro-mechanical controls. *No bolts or nuts to loosen or tighten by hand.*

Magnetic dry particle clutch provides vibration-free drive for smooth surface finish. Power is transmitted via belt to clutch from main motor mounted on left side of machine. Instantaneous braking is assured by magnetic dry disc brake.

Copying attachment with electric tracer for use on cross rail or side head.

Model KZ Double Column Vertical Boring Mills with 65", 80", 98" and 118" turning diameters.



All operating features of KE Series Vertical Turret Lathes are combined in

SCHIESS KZ DOUBLE COLUMN VERTICAL BORING MILLS, PLUS—

Heads equipped with steel octagon rams can be swiveled—have automatic feed in vertical, horizontal and angular direction and are independent of one another as to amounts and direction of feed. Table operated by three-button pendant control. Standard model KZ Double Column Vertical Boring Mills are available with 65", 80", 98" and 118" turning diameters.

Get to know these products of Europe's largest builder of heavy machine tools. Parts and service are as close as Pittsburgh. An American Schiess engineer will be happy to help you size up these heavy producers for your heavy production needs. Write for catalogs and complete specifications on these and all Schiess KE machines.

engineering division **SCHIESS**

AMERICAN SCHIESS CORPORATION

1232 Penn Avenue, Pittsburgh 22, Pa.

An Even Better

WITH THE SAME

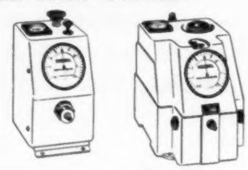
IMPROVED ZERO SETTING

The zero setting adjustment is improved mechanically. The pointer is set directly to zero — positively, without additional adjustment.

NEW PROTECTION FOR AIR METER

A new piping arrangement assures effective protection of the Air Meter from dirt, oil and water.

ONE THIRD SMALLER



Compact, easy to handle — more adaptable for use on machine tools. Beautiful, dirt-resisting finish.

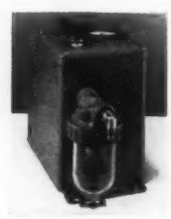
NEW IMPROVED REGULATOR (At Top)

A better and smaller regulator assures constant air pressure and enables a reduction in size of the complete gage. Setting can be locked to prevent accidental change of zero setting.

FINGER TIP ATTACHMENT OF GAGING UNITS

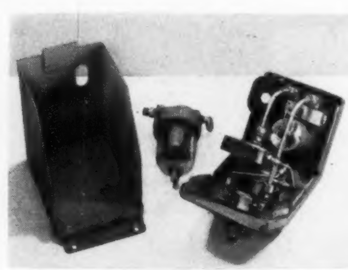
Knurled collar attaches all gaging units quickly: one hand only required. "O" Rings assure air-tight connection. No wrenches needed.

ONLY AIR GAGE WITH BUILT-IN ACCURACY THAT ENABLES USE OF ONE MASTER



BETTER FILTER with TRANSPARENT BOWL

New sintered bronze element filters out dirt and coagulated oil. Condition of air lines can be readily checked by observing filter bowl. Attached directly to gage, it eliminates extra piping.



ALL COMPONENTS EASILY ACCESSIBLE

One-piece top and front easily removed with all components and connections attached. Quick, easy servicing, if necessary.

DIMENSIONAIR

BASIC, NO-DRIFT SYSTEM

The Dimensionair system is basically sound in principle. Its accuracy is proved constant and dependable every day in practice.

However, no gage maker can control all the elements, human and technical, that influence the proper use of his product but he can incorporate features which tend to eliminate these faults and improve the actual use of his instruments.

That is the purpose of these new refinements which have been built into the Dimensionair.

Most air lines installed in plants were NEVER INTENDED to be used for precision instruments of any kind. Hence, the Dimensionair is now made EVEN MORE IMMUNE to unclean air and variations in air pressures.

Adjustments are more foolproof.

Smaller size makes the gage EASIER TO HANDLE and increases its adaptability for general use . . . and for multiple use.

Since any instrument is subject to all degrees of treatment it must be EASY TO SERVICE when the unusual or unexpected upsets its normal function. In the new and smaller Dimensionair all components and connections are quickly and easily accessible.

In every way the Dimensionair provides you with constant accuracy and GREATER DEPENDABILITY, adaptability and service. That's why more and more inspection people buy it. Why don't YOU try it? Write or call us at our nearest office.

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Federal's solution to the cost of gaging:

Impartial Gage Selection
Engineering Follow-Through
Everything in Gages

Ask **FEDERAL** *First*

FOR RECOMMENDATIONS IN MODERN GAGES . . .

Dial Indicating, Air, Electric, or Electronic — for Inspecting, Measuring, Sorting, or Automation Gaging

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ARC WELDERS—See Welding Equipment, Arc

AUTOMATIC SCREW MACHINES—See Screw Machines, Single- and Multiple-Spindle Automatic

BABBITT
American Crucible Products Co., Lorain, Ohio.
Ryerson, Jos. T., & Son, 2558 W. 16th St., Chicago 18, Ill.

BALANCING EQUIPMENT
Gisholt Machine Co. (Static and Dynamic), 1245 E. Washington Ave., Madison 10, Wis.
LaSalle Tool, Inc., 3840 E. Outer Dr., Detroit 34, Mich.
Sundstrand Mach. Tool Co., 2531 11th St., Rockford, Ill.

BALL-MAKING MACHINES
Haynes Stellite Co., Kokomo, Ind.
New Departure Div., Bristol, Conn.

BAR MACHINES—See Screw Machines, Single- and Multiple-Spindle, Automatic

BAR STOCK, Non-ferrous
American Crucible Prod. Co., Port Huron, Mich.
Bunting Brass & Bronze Co., 715 Spencer, Toledo, Ohio.
Centrifugally Cast Products Div., Shenango Furnace Co., Dover, Ohio.
Mueller Brass Co., Port Huron, Mich.
Ryerson, Jos. T., & Son, 2558 W. 16th St., Chicago 18, Ill.

BAR STOCK AND SHAFTING, Steel
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Boston Gear Works, 14 Hayward St., Quincy 71, Mass.
Carpenter Steel Co., 105 W. Bern St., Reading, Pa.
Crucible Steel Co. of America, Henry W. Oliver Bldg., Mellon Sq., Pittsburgh 22, Pa.
Cumberland Steel Co., Cumberland, Md.
Ryerson, Jos. T., & Son, 2558 W. 16th St., Chicago 18, Ill.

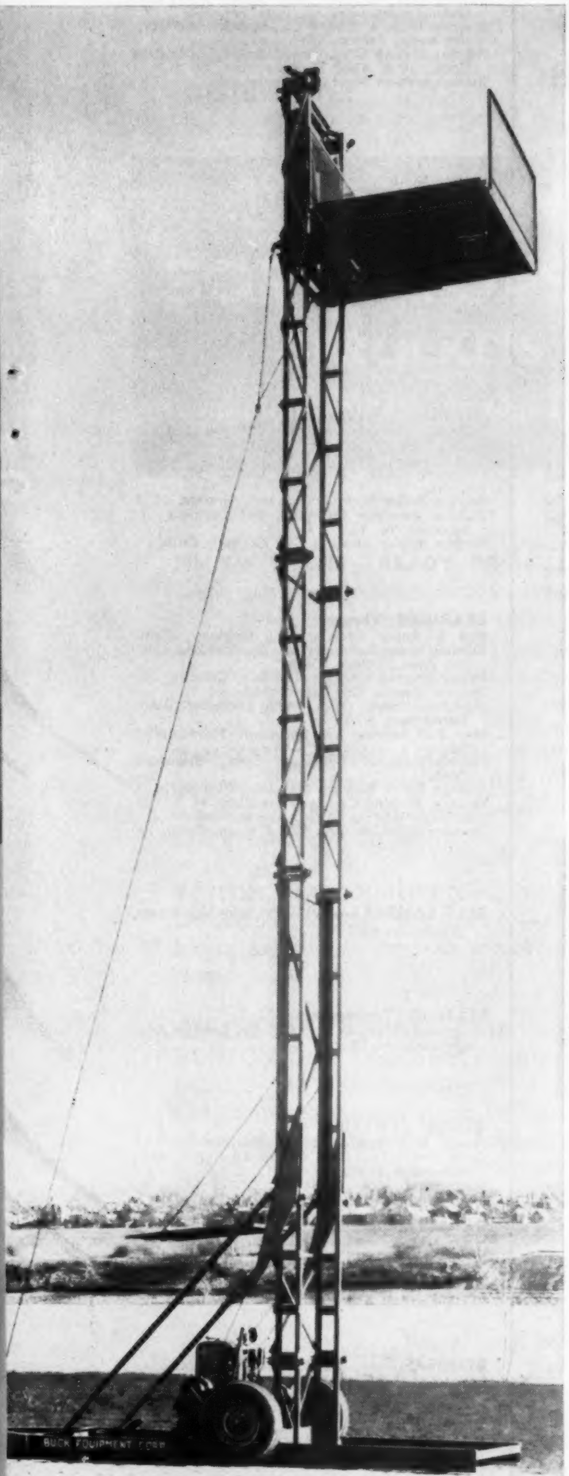
BARS, Steel
Allegheny Ludlum Steel Corp., Bethlehem, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Columbia Tool Steel Co., Chicago Hts., Ill.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Timken Roller Bearing Co., Canton, Ohio.
U. S. Steel Corp. (American Steel & Wire Co Div., Carnegie-Illinois Steel Corp. Div., Columbia Steel Co. Div., Tennessee Coal, Iron & R. R. Co. Div.), 436 7th Ave., Pittsburgh, Pa.
Wheelock, Lovejoy & Co., Inc., Cambridge Mass.

BEARING PILLOW BLOCKS AND CARTRIDGES
Fafnir Bearing Co., New Britain, Conn.

BEARINGS, Ball
Ball & Roller Bearing Co., Danbury, Conn.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Fafnir Bearing Co., New Britain, Conn.
Federal Bearings Co., Inc., Poughkeepsie, New York
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
New Departure Div., Bristol, Conn.
Nice Ball Bearing Co., 30th & Hunting Park Ave., Philadelphia, Pa.
Norma-Hoffman Bearings Corp., Stamford, Conn.

(Continued on page 266)

How Shelby Seamless Tubing makes a "Buck" go farther



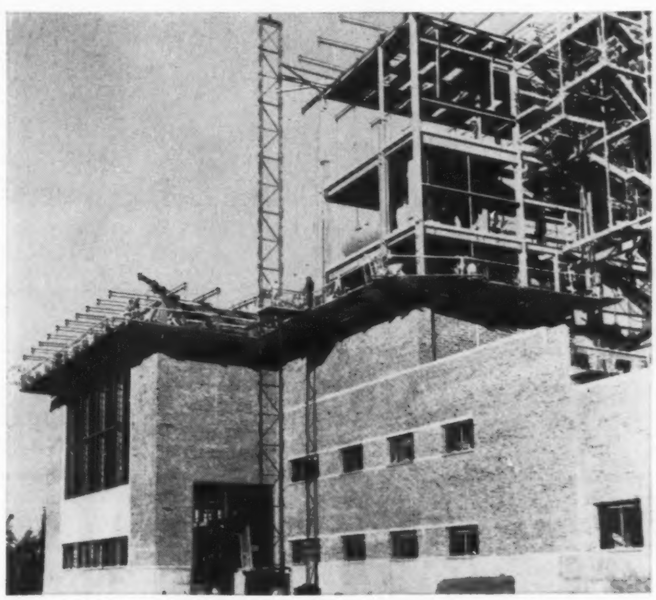
The platforms of these Buck Equipment Corporation Hoisting Machines* *do* go farther—farther *up*, thanks to Shelby Seamless. Although standard tower heights range from 25 to 40 feet, some of these unique heavy-duty rigs boast towers up to 150 feet in height!

The slender tower of the Buck Portable Hoisting Machine is constructed of 2⅜" OD x .120" wall, cold drawn sections of Shelby Seamless Mechanical Tubing, which afford both the structural support for the equipment and the track on which the platform moves. Self-erecting, the tower unfolds like a jack-knife—raises or lowers in 2 minutes, 11 seconds. Operating power is supplied by a 21 H. P. air-cooled engine.

Here is an application where the use of seamless tubing is virtually mandatory. What other material could supply the combination of high strength, light weight, and flexibility needed to make a completely portable hoist that would unlimber in minutes, then send a 2000-pound load of building bricks soaring up its vertical track at the rate of 140 feet per minute?

Shelby Seamless Tubing possesses the strength, uniformity and dimensional accuracy that make it ideal for structural applications such as this. Produced to exacting standards by the world's largest manufacturer of tubular steel products, Shelby Seamless is available in a wide range of diameters, wall thicknesses, various shapes and steel analyses. You are invited to consult our engineers at any time. They will make a study of your product requirements and will help you to apply Shelby Seamless to your specifications.

**Manufacturer's name on request.*



NATIONAL TUBE DIVISION, UNITED STATES STEEL CORPORATION, PITTSBURGH, PA.
(Tubing Specialties)

COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS • UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS

SHELBY SEAMLESS MECHANICAL TUBING

WALLS WITHOUT WELDS

UNITED STATES STEEL

BEARINGS, Bronze and Special Alloy
American Crucible Products Co., 1395 Oberlin Ave., Lorain, Ohio
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Shenango-Penn Mold Co., Dover, Ohio.

BEARINGS, Needle
Orange Roller Bearing Co., Inc., Orange, N. J.

BEARINGS, Oilless
American Crucible Prod. Co., Lorain, Ohio.
Bunting Brass & Bronze Co., 715 Spencer, Toledo 1, Ohio.
Ryerson, Jos. T., & Son, 2558 W. 16th St., Chicago 18, Ill.

BEARINGS, Roller
Ball & Roller Bearing Co., Danbury, Conn.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Orange Roller Bearing Co., Inc., Orange, N. J.
Rollway Bearings Co., Inc., 541 Seymour St., Syracuse, N. Y.
Timken Roller Bearing Co., Canton, Ohio.

BEARINGS, Thrust
Ball & Roller Bearing Co., Danbury, Conn.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Fafnir Bearing Co., New Britain, Conn.
General Electric Co., Schenectady, N. Y.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Nice Ball Bearing Co., Nicetown, Philadelphia, Pa.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Orange Roller Bearing Co., Inc., Orange, N. J.
Rollway Bearing Co., Inc., Syracuse, N. Y.
Shenango-Penn Mold Co., Dover, Ohio.
Timken Roller Bearing Co., Canton, Ohio.

BELT SANDERS—See Grinding Machines, Abrasive Belt

BELTING, Transmission
Houghton, E. F. & Co., 303 W. Lehigh Ave., Philadelphia, Pa.

BENCH CENTERS
Brown & Sharpe Mfg. Co., Providence, R. I.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Sundstrand Mch. Tool Co., 2531—11th St., Rockford, Ill.

BENCHES AND STOOLS
South Bend Lathe Works, South Bend 22, Ind.

BENDERS, Bar, Tube, Channel, etc.
Bath, Cyril Co., 32324 Aurora Road, Solon, Ohio.
Greenless Bros. & Co., 2136—12th St., Rockford, Ill.

BENDERS, Plate, Etc.
Bath, Cyril Co., 32324 Aurora Road, Solon, Ohio.
Cincinnati Shaper Co., Hopple & Gerrard, Cincinnati, Ohio.
Niagara Mch. & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.

(Continued on page 268)

For more information fill in page number on Inquiry Card, on page 225

BENDING MACHINES, Hydraulic

Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Chambersburg Engrg. Co., Chambersburg, Pa.
Farquhar, A. B., Div. Oliver Corp., York, Pa.
Hannifin Corp., 501 Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Sta., Buffalo, N. Y.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

BENDING MACHINES, Pipe

Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Farquhar, A. B., Div. Oliver Corp., York, Pa.

BENDING ROLLS

Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., Cleveland, Ohio.
Niagara Mch. & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.

BLAST CLEANING EQUIPMENT

Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 38, Mich.
Pangborn Corp., Hagerstown, Md.

BLOWERS

Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.

BLUING LAYOUT

Dykem Co., 2307 N. 11th St., St. Louis 6, Mo.

BLUEPRINT MACHINERY & ACCESSORIES

Wickes Brothers, 512 No. Water St., Saginaw, Mich.

BOLTS, NUTS AND SCREWS

Allen Mfg. Co., 133 Sheldon St., Hartford 2, Conn.
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Ottemiller, W. H., & Co., York, Pa.
Parker-Kalon Div., Clifton, N. J.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Standard Pressed Steel Co., Jenkintown, Pa.
Williams & Co., J. H., 400 Vulcan St., Buffalo 7, N. Y.

BOOKS, Technical

Industrial Press, 93 Worth St., New York 13, N. Y.

BORING BARS

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Bullard Co., 286 Canfield Ave., Bridgeport 6, Conn.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Ingersoll Milling Machine Co., 2442 Douglas St., Rockford, Ill.
McCrosky Tool Corp., Meadville, Pa.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Scully-Jones & Co., 1906 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.
Van Norman Mch. Co., 3640 Main St., Springfield 7, Mass.
Warner & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio.
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

(Continued on page 272)

For more information fill in page number on Inquiry Card, on page 225

B Product Directory

Because these solenoid covers are essential to valve operation, they are chained to the valves. Also, they fasten with 4 "captive" screws that cannot be mislaid. A manual operating button makes it possible to operate the valve without removing its cover.

Now! solenoid-controlled air valves that defy improper maintenance ...they won't operate with their covers off!

When a solenoid valve operates without its cover, trouble is not far off. Dirt, oil, cutting fluid, chips are sure sooner or later to jam the solenoid, and the valve will fail to shift.

That can't happen with these new Hannifin valves!

The solenoids are held in place by their covers and won't operate the valves unless the dust-tight, splashproof covers are firmly tightened.

These new valves, which conform to the latest J.I.C. recommendations, are part of the complete "P-M" Pilot-Master line. New heads with these new solenoid covers are offered on 2-way, 3-way and 4-way Pilot-Master Valves (air-operated). The smaller, direct-operated 3-way and 4-way valves in the "P-M" line have been redesigned to use the same new covers. This added feature is just another reason why it pays to standardize on Hannifin air control valves.

AIR CONTROL

HANNIFIN

VALVES

Complete information on all Hannifin Air Control Valves is in this catalog. It belongs in your files. Write for your copy. Hannifin Corporation, 509 S. Wolf Road, Des Plaines, Illinois.

For more information fill in page number on Inquiry Card, on page 225

BORING HEADS

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio.
Bridgeport Machines, Inc., 500 Lindley St., Bridgeport 6, Conn.
Bryant Chucking Grinder Co., Clinton St., Springfield, Vt.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Homestrand, Inc., Larchmont, N. Y.
Michigan Drill Head Co., Van Dyke, Mich.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Mummert-Dixon Co., Hanover, Pa.
Standard Electrical Tool Co., 2500 River Rd., Cincinnati 4, Ohio.
Universal Engineering Co., Frankenmuth 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

BORING MACHINES

Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Bullard Co., Bridgeport 6, Conn.
Consolidated Mch. Tool Div., 565 Blossom Rd., Rochester 10, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Davis & Thompson Co., 4460 N. 24th St., Milwaukee 10, Wis.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Gray Co., G. A., 3611 Woodburn Ave., Cincinnati 7, Ohio.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Homestrand, Inc., Larchmont, N. Y.
Kearney & Trecker Corp., Milwaukee, Wis.
LaSalle Tool, Inc., 3840 E. Outer Dr., Detroit 34, Mich.
Michigan Drill Head Co., Van Dyck, Mich.
Millholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Moline Tool Co., Moline, Ill.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Olofsson Corp., Lansing, Mich.
Pope Machinery Co., Haverhill, Mass.
Sheffield Corp., Box 893, Dayton 1, Ohio
Snyder Tool & Engrg. Co., 3400 E. Lafayette St., Detroit 9, Mich.
Wadell Equipment Co., Clark, N. J.
Wales-Strippit Co., No. Tonawanda, N. Y.

BORING MILLS, Horizontal

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Bullard Co., Bridgeport 6, Conn.
Cincinnati Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio.
Consolidated Mch. Tool Div., 565 Blossom Rd., Rochester 10, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., 3611 Woodburn Ave., Cincinnati 7, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Lucas Mch. Tool Div., New Britain Mch. Co., 12302 Kirby Ave., Cleveland 8, Ohio.
New Britain Mch. Co., New Britain, Conn.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

BORING MILLS, Vertical

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Bullard Co., 286 Canfield Ave., Bridgeport 6, Conn.
Consolidated Mch. Tool Div., 565 Blossom Rd., Rochester 10, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
New Britain Mch. Co., New Britain, Conn.
Portage Mch. Co., 1025 Sweitzer Ave., Akron 11, Ohio.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.

BORING TOOLS
American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Apex Tool & Cutter Co., Inc., 235 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Bullard Co., 286 Canfield Ave., Bridgeport 6, Conn.
Crucible Steel Co. of America, Henry W. Oliver Bldg., Mellon Sq., Pittsburgh 22, Pa.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Eclipse Counterbore Co., 1600 Bonner Ave., Detroit 20, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Portage Machine Co., 1025 Sweitzer Ave., Akron 11, Ohio.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scully-Jones & Co., 1906 Rockwell St., Chicago 8, Ill.
Star Cutter Co., 34500 Grand River, Farmington, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

BRAKES, Press and Bending
Bath, Cyril Co., 32324 Aurora Road, Solon, Ohio.
Cincinnati Shaper Co., Hopple & Gerrard, Cincinnati, Ohio.
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Dreis & Krump Mfg. Co., 7400 Loomis Blvd., Chicago 36, Ill.
Ferracute Machine Co., Bridgeton, N. J.
Lodge & Shipley Co., Hamilton 1, Ohio.
Niagara Mch. & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.

BRASS
American Brass Co., 25 Broadway, New York, N. Y.
Bridgeport Brass Co., Bridgeport, Conn.
Mueller Brass Co., Port Huron 35, Mich.
Revere Copper & Brass, Inc., 230 Park Ave., New York, N. Y.

BROACHES
American Broach & Mch. Co., Ann Arbor, Mich.
Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Detroit Broach Co., Inc., 950 S. Rochester Rd., Rochester, Mich.
duMont Corp., Greenfield, Mass.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Lapointe Mch. Tl. Co., Tower St., Hudson, Mass.
Metallurgical Products Dept. of General Electric Co., Box 237 Roosevelt Park Annex, Detroit 32, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Sundstrand Mch. Tool Co., 2531—11th St., Rockford, Ill.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

BROACHING MACHINE, Internal
American Broach & Mch. Co., Ann Arbor, Mich.
Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Detroit Broach Co., Rochester, Mich.
Lapointe Mch. Tl. Co., Tower St., Hudson, Mass.
Sundstrand Mch. Tool Co., 2531—11th St., Rockford, Ill.
Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.

BROACHING MACHINE, Surface
American Broach & Mch. Co., Ann Arbor, Mich.
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati, Ohio.
Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Detroit Broach Co., Rochester, Mich.

(Continued on page 274)

Foote-Burt Co., 13000 St. Clair Ave., Cleveland 8, Ohio
Lapointe Mch. Tl. Co., Tower St., Hudson, Mass.
Sundstrand Mch. Tool Co., 2531—11th St., Rockford, Ill.

BRONZE

American Brass Co., Waterbury 20, Conn.
American Crucible Products Co., 1395 Oberlin Ave., Lorain, Ohio.
Bridgeport Brass Co., Bridgeport, Conn.
Mueller Brass Co., Port Huron 35, Mich.

BRUSHES, Industrial, Tampico, Wire Wheel, Etc.

Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland, Ohio.

BUFFERS

Delta Power Tool Div., 400 Lexington Ave., Pittsburgh 8, Pa.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.

BULLDOZERS, Metalforming

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Erie Foundry Co., Erie, Pa.
Farquhar Div., A. B., 142 N. Duke St., York, Pa.
Lake Erie Engineering Corp., 470 Woodward Ave., Buffalo 17, N. Y.

BURNISHING MACHINES

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.

BURRING MACHINES—See Deburring Machines

BURRS—See Files and Burrs, Rotary

BUSHINGS, Drill Jig

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Metal Carbides Corp., 6001 Southern Blvd., Youngstown 12, Ohio.
Universal Engrg. Co., Frankenmuth, Mich.

BUSHINGS, Hardened Steel

Brown & Sharpe Mfg. Co., Providence, R. I.
Universal Engrg. Co., Frankenmuth, Mich.

BUSHINGS, Non-ferrous and Powdered Metal

American Crucible Products Co., Lorain, Ohio.
Bunting Brass & Bronze Co., 715 Spencer, Toledo, Ohio.
Universal Engrg. Co., Frankenmuth, Mich.

CABINETS, Tool

Brown & Sharpe Mfg. Co., Providence, R. I.
Standard Pressed Steel Co., Jenkintown, Pa.

CALIPERS, Spring, Firm-Joint, Transfer, Termaphrodite, etc. —See Layout and Drafting Tools; Machinists' Small Tools

CALIPERS, Vernier

Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., Des Plaines, Ill.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S. Co., Athol, Mass.

(Continued on page 276)

CAM CUTTING MACHINES

Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Pratt & Whitney Co., Inc., West Hartford, Conn.
Russell Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Van Norman Mch. Co., 3640 Main St., Springfield 7, Mass.

CAM MILLING AND GRINDING MACHINES

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Cincinnati Milling Machine Co., Oakley, Cincinnati, Ohio.
Landis Tool Co., Waynesboro, Pa.
Rowbottom Machine Co., Waterbury, Conn.

CAMS

Brown & Sharpe Mfg. Co., Providence, R. I.
Eisler Engrg. Co., Inc., 750 S. 13th, Newark 3, N. J.
Rowbottom Machine Co., Waterbury, Conn.

CARBIDES

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Besley-Wells Corp., 112 Dearborn Ave., South Beloit, Ill.
Chicago-Latrobe Twist Drill Wks., 411 W. Ontario St., Chicago 10, Ill.
DoAll Co., Des Plaines, Ill.
Kennametal, Inc., Latrobe, Pa.
Linde Air Products Co., 30 E. 42nd St., New York 17, N. Y.
Metal Carbides Corp., Youngstown, Ohio
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

CASTINGS, Die

American Brass Co., Waterbury 20, Conn.
Madison-Kipp Corp., Madison, Wis.

CASTINGS, Non-ferrous

American Crucible Products Co., Lorain, Ohio
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Centrifugally Cast Products Div.—Shenango Furnace Co., Dover, Ohio
Dow Chemical Co., Midland, Mich.
Mueller Brass Co., Port Huron 35, Mich.

CASTINGS, Gray Iron, Malleable

Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Centrifugally Cast Products Div.—Shenango Furnace Co., Dover, Ohio
Challenge Mchry. Co., Grand Haven, Mich.
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

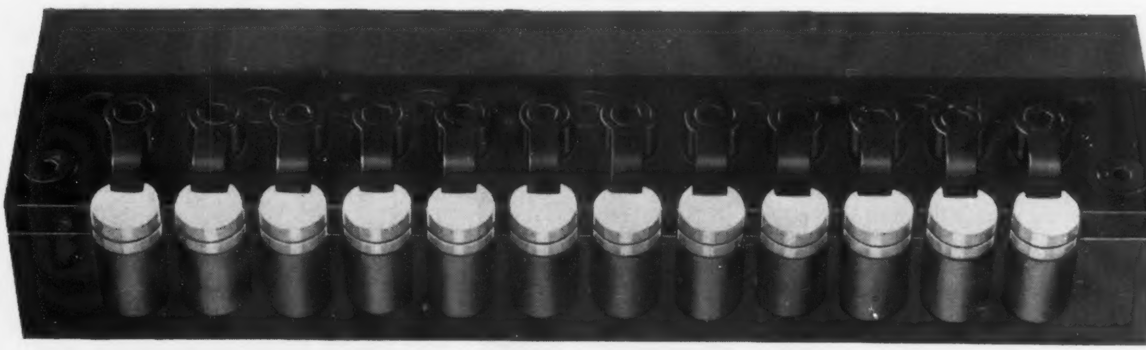
CASTINGS, Steel, Stainless, etc.

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Crucible Steel Co. of America, Henry W. Oliver Bldg., Pittsburgh 22, Pa.
Farrel-Birmingham Co., Inc., Ansonia, Conn.

CEMENT, Abrasive Disc

Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

(*Continued on page 278*)



Kendex* multiple grooving tool, with 12 Kennametal "turnover" button inserts, and shims of Kennametal for fast groove cutting and rapid, accurate indexing

KENNAMETAL* Tooling for Special Jobs

Kendex principle is adaptable to a wide variety of job requirements

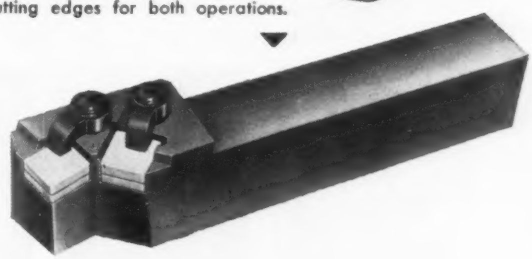
Many machining jobs often can be done better, faster, or at less cost with a new cutting tool . . . or a tool that is adapted to the existing conditions. The photographs illustrate this point, showing Kendex* Tooling re-designed for specific jobs.

Experienced Kennametal engineers will work with you to find the best approach to your metal-cutting problems. Often a modified standard tool is the answer, and your Kennametal tool engineer will recommend it. Sometimes an entirely new approach with specialized tooling may be the only solution to improve production. In either case, the chances are that Kennametal's experience during the last 18 years has solved a similar problem. Result: Time is saved . . . development work is reduced to a minimum . . . the basic design has been proven.

If you have a stubborn, high-cost production job, perhaps your Kennametal tool engineer can quickly suggest a solution. He devotes his time exclusively to tooling problems with one objective —to get the right tool and right grade of Kennametal on the job. His broad experience in tool design and tool application is supplemented by that of our Research and Engineering staffs. All are constantly at work to provide the best tools and most practical techniques for metal-cutting and forming operations. Call your Kennametal Representative or write to KENNAMETAL INC., Latrobe, Pa.

Boring bar utilizing Kendex clamped-holder principle and Kennametal triangular inserts of the "turn-over" throw-away type . . . eliminates grinding . . . reduces downtime.

Facing and chamfering completed in one pass with a two-in-one Kendex Tool and Kennametal inserts. Another advantage: Since only the middle of chamfering insert is used, the two inserts may be interchanged after use, thus doubling the number of cutting edges for both operations.



*Trademarks

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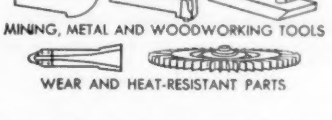
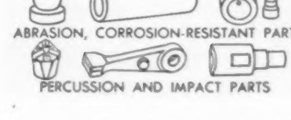


INDUSTRY AND KENNAMETAL ...Partners in Progress



For more information fill in page number on Inquiry Card, on page 225

CENTER-DRILLING MACHINES

Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio
La Salle Tool Inc., 3840 E. Outer Dr., Detroit 34, Mich.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

CENTER PUNCHES — See Machinists' Small Tools

CENTERS, Grinding Machines, Indexing Head and Lathe

Brown & Sharpe Mfg. Co., Providence, R. I.
Buck Tool Co., 220 Schippers Lane, Kalamazoo, Mich.
Metal Carbides Corp., Youngstown, Ohio
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit, Mich.
Scully Jones & Co., 1906 Rockwell St., Chicago 8, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

CERAMIC TOOL MATERIAL—See Tool Material, Ceramic

CHAINS, Power Transmission and Conveyor

Boston Gear Works, 14 Hayward St., Quincy 71, Mass.

CHUCKING MACHINES, Single-Spindle Automatic

Bullard Co., 286 Canfield Ave., Bridgeport 6, Conn.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio
Coulter, James Mch. Co., 629 Railroad Ave., Bridgeport 5, Conn.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Jones & Lamson Mch. Co., Springfield, Vt.
National Acme Co., 170 E. 131st St., Cleveland, Ohio
Potter and Johnson Co., 1027 Newport Ave., Pawtucket, R. I.
Reid Bros. Co., Inc., Beverly, Mass.
Russell Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 83, Ohio

CHUCKING MACHINES, Multiple-Spindle Automatic

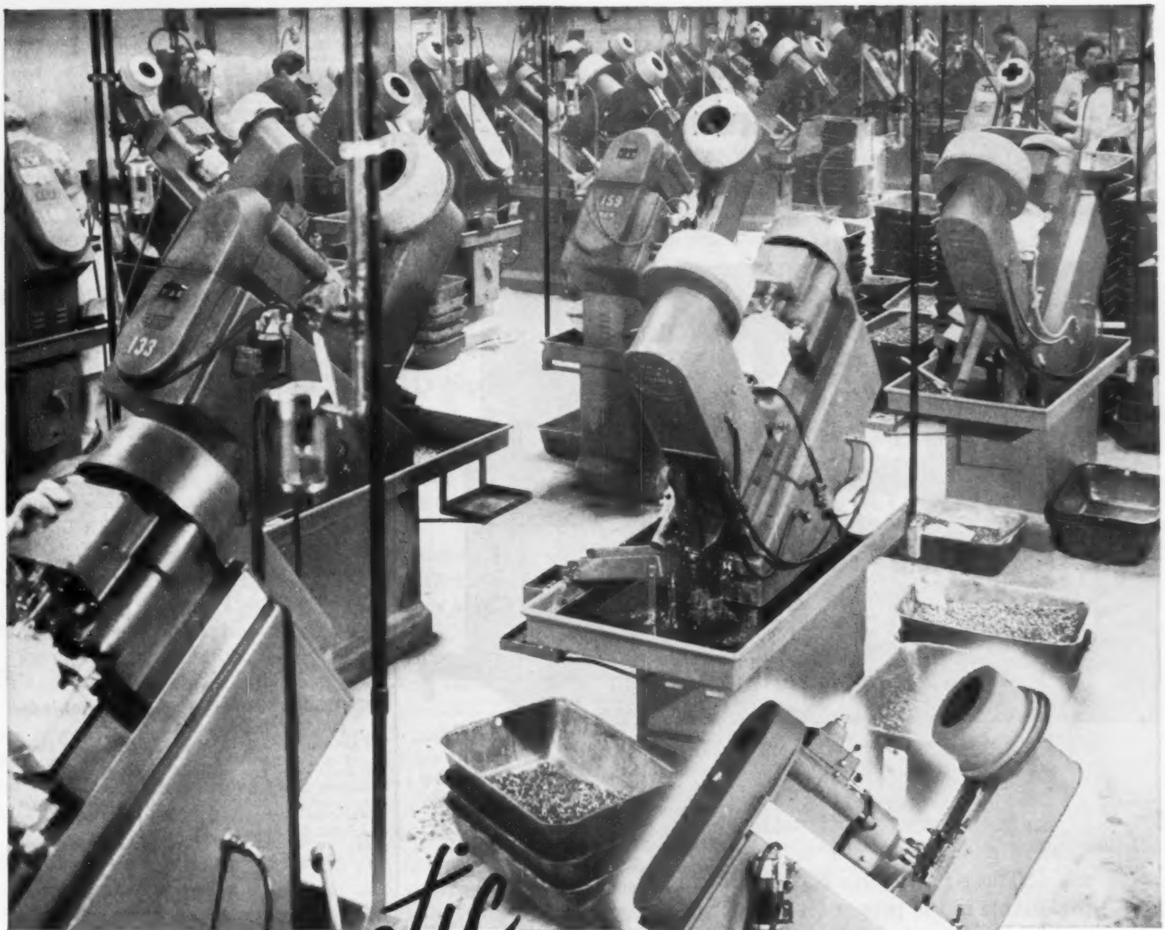
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bullard Co., 286 Canfield Ave., Bridgeport 6, Conn.
Cone Automatic Mch. Co., Inc., Windsor, Vt.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Goss & DeLeeuw Mch. Co., Kensington, Conn.
National Acme Co., 170 E. 131st St., Cleveland, Ohio
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Olofsson Corp., 2729 Lyons Ave., Lansing, Mich.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Warner & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio
Wickes Brothers, 512 No. Water St., Saginaw, Mich.

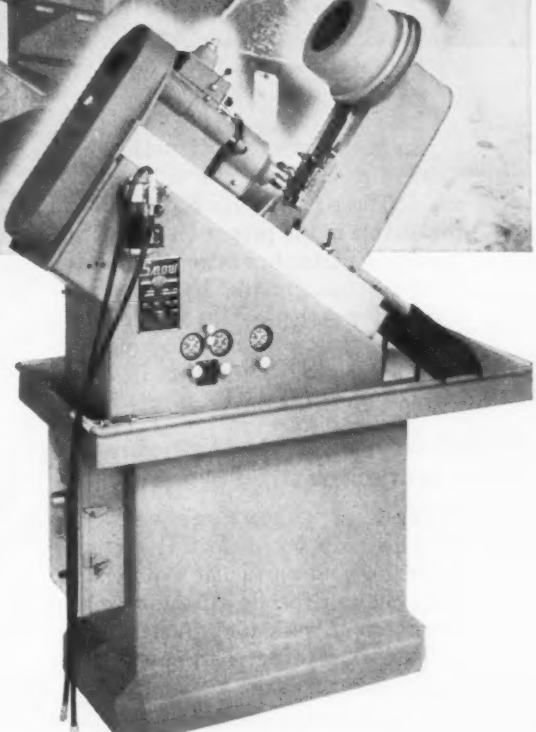
CHUCKS, Air Operated

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Buck Tool Co., 220 Schippers Lane, Kalamazoo, Mich.
Cushman Chuck Co., Windsor Ave., Hartford 2, Conn.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.

(*Continued on page 280*)

C Product Directory





Automatic NUT TAPPING MACHINES

This installation *at Shakeproof, Division of Illinois Tool Works, Elgin, Illinois,* is an illustration of productivity—*with precision.*

Simplicity of set-up and lower operational costs can make your Nut Tapping Department one of the most efficient and profitable in your plant. Submit samples and prints for a comparison with your present method.

VERTICAL DRILLING MACHINES
VERTICAL TAPPING MACHINES
VERTICAL THREADING MACHINES
TWO SPINDLE MACHINES
ANGULAR MACHINES
NUT TAPPING MACHINES
HORIZONTAL MACHINES
DRILLING AND TAPPING UNITS
AUTOMATIC JIGS AND FIXTURES
DRILL PRESS TAP HEADS

SNOW

MANUFACTURING COMPANY

435 EASTERN AVENUE, BELLWOOD, ILL.

(Suburb of Chicago)

For more information fill in page number on Inquiry Card, on page 225

Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Schraders Son, A., 470 Vanderbilt Avenue, Brooklyn, N. Y.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio

CHUCKS, Collet

Brown & Sharpe Mfg. Co., Providence, R. I
Bryant Chucking Grinder Co., Clinton St., Springfield, Vt.
Chicago Tool & Engrg. Co., 8389 So. Chicago Ave., Chicago, Ill.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio
Cushman Chuck Co., 800 Windsor St., Hartford 2, Conn.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Errington Mech. Lab. Inc., 24 Norwood Ave., Staten Island 4, N. Y.
Gisholt Mch. Co., 1245 E. Washington Ave., Madison 10, Wis.
Gorton Mch. Co., Geo., 1321 Racine St., Racine, Wis.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Jacobs Mfg. Co., West Hartford 10, Conn.
Kearney & Trecker Corp., Milwaukee 14, Wis.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Universal Engrg. Co., Frankenmuth 2, Mich.
Warner & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio

CHUCKS, Combination Universal-Independent

Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Gisholt Mch. Co., Madison 10, Wis.
Horton Chuck, Windsor Locks, Conn.
Kearney & Trecker Corp., Milwaukee 14, Wis.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio
Skinner Chuck Co., 95 Edgwood Ave., New Britain, Conn.

CHUCKS, Compensating

Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Logansport Mch. Co., Inc., Logansport, Ind.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

CHUCKS, Diaphragm

Bryant Chucking Grinder Co., Clinton St., Springfield, Vt.
Wadell Equip. Co., Terminal Ave., Clark, N. J.

CHUCKS, Drill, Key Type

Delta Power Tool Div., 400 Lexington Ave., Pittsburgh 8, Pa.
Jacobs Mfg. Co., West Hartford, Conn.
Supreme Products, Inc., 2222 So. Calumet Ave., Chicago 16, Ill.

CHUCKS, Drill, Keyless

Delta Power Tool Div., 400 Lexington Ave., Pittsburgh 8, Pa.
Jacobs Mfg. Co., West Hartford, Conn.
Scully-Jones & Co., 1906 Rockwell St., Chicago 8, Ill.
Supreme Products, Inc., 2222 So. Calumet Ave., Chicago 16, Ill.

CHUCKS, Full Floating

Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, Staten Island, N. Y.
Gisholt Mch. Co., Madison 10, Wis.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.

(Continued on page 282)

For more information fill in page number on Inquiry Card, on page 225

AXELSON production and maintenance news

AXELSON MANUFACTURING COMPANY / DIVISION OF U.S. INDUSTRIES, INC. / 6160 SOUTH BOYLE AVENUE, LOS ANGELES 58, CALIFORNIA

New 4025 heavy-duty lathe has 75 hp headstock... handles peak loads to 100 hp

Axelson's new 4025 (formerly 32") heavy-duty lathe is a rugged tool that can be used with equal effectiveness on rough or precision cuts. It has 24 spindle speeds in true geometric progression from 6 to 750 RPM.

The main bed casting is designed for maximum stability and for resistance to the twisting forces of heavy-duty turning. The carriage bed ways are hardened and ground alloy steel.

Two levers control the selection of feed changes on the new Axelson totally enclosed gear box. There are 81 feeds, ranging from .005" to .351" per revolution of the spindle; 45 threads may be cut, ranging from 1 to 30 threads per inch. This range of feeds and leads is sufficient for the large majority of all machining operations.

The extra-heavy, box-type apron is completely enclosed, which permits all shafts and gears to run in a continuous oil bath. All carriage controls are located on the apron convenient to the operator. Clutch levers operate cross and longitudinal feed controls.

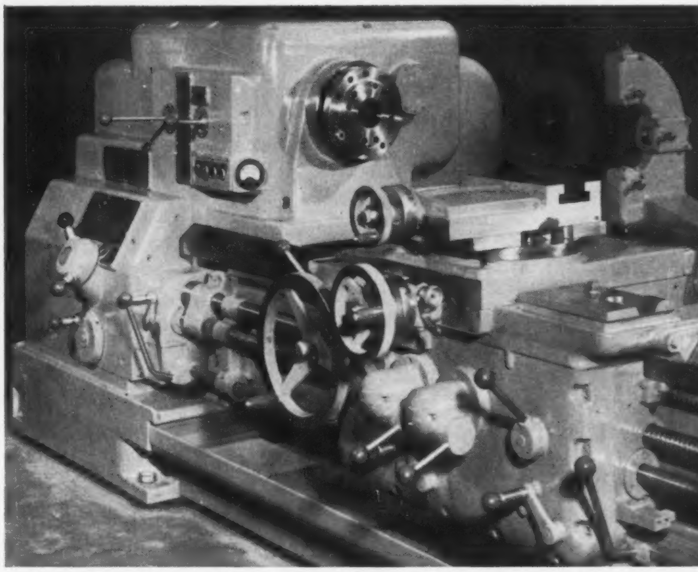
The tailstock is a rugged one-piece casting. The two-speed feature provides rapid movement of the tailstock center up to the work piece, and slow powerful movement of the spindle for feeding drills, reamers, or other tools held in center. The tailstock can be easily moved manually in either direction by a hand crank at the front of the machine.

A micrometer cross-feed positive stop, which permits the operator to set the cross-slide travel to stop at a predetermined point, is positive, will not slip, and will permit accurate dimensions to be duplicated repeatedly.

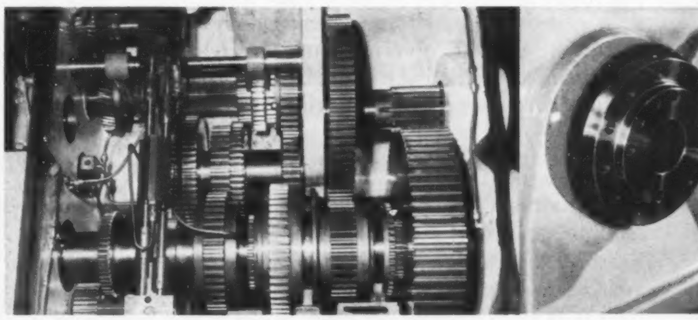
Optional equipment is the power rapid traverse for quickly moving the carriage in either direction. This feature saves valuable production time and reduces operator fatigue to a minimum. A lever mounted at the left-hand side of the carriage controls the carriage movement.

For a complete description and detailed specifications on Axelson Tool Room, Medium-Duty and the new 2516 and 4025 Heavy-Duty Lathes: Write for bulletins 5507 and 5504 M12

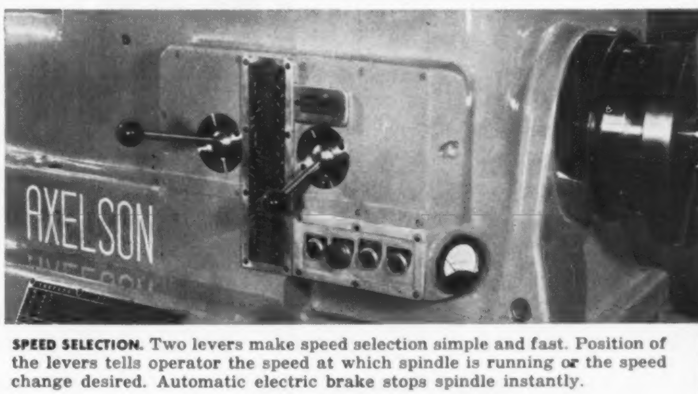
AXELSON Manufacturing Company
Division of U. S. Industries, Inc.



NEW 4025 HEAVY-DUTY LATHE. Designed for flexible, effective operations, this machine combines rugged construction and precise operation.



HEADSTOCK. Twenty-four spindle speeds divided into a true geometric progression from 6 to 750 RPM are ideally suited for a wide variety of work, permitting high speed turning and large diameter work in new metals and alloys.



SPEED SELECTION. Two levers make speed selection simple and fast. Position of the levers tells operator the speed at which spindle is running or the speed change desired. Automatic electric brake stops spindle instantly.

CHUCKS, Gear

Bryant Chucking Grinder Co., Clinton St. Springfield, Vt.
Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Horton Chuck, Windsor Locks, Conn.
Supreme Products, Inc., 2222 So. Calumet Ave., Chicago, Ill.

CHUCKS, Independent

Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Gisholt Mch. Co., Madison 10, Wis.
Homestrand, Inc., Larchmont, N. Y.
Horton Chuck, Windsor Locks, Conn.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

CHUCKS, Lathes, etc.

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Buck Tool Co., 220 Schippers Lane, Kalamazoo, Mich.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Chicago Tool & Eng. Co., 8389 So. Chicago Ave., Chicago, Illinois (Milling Machine)
Cushman Chuck Co., Windsor Ave., Hartford 2, Conn.
Gisholt Mch. Co., Madison 10, Wis.
Horton Chuck, Windsor Locks, Conn.
Jacobs Mfg. Co., West Hartford, Conn.
Jones & Lamson Mch. Co., Springfield, Vt.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio

CHUCKS, Magnetic

Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Hanchett Magna-Lock Corp., Big Rapids, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Walker, O. S., Co., Inc., Worcester, Mass.

CHUCKS, Power Operated

Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Gisholt Mch. Co., Madison 10, Wis.
Logansport Mch. Co., Inc., Logansport, Ind.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

CHUCKS, Quick Change and Safety

Chicago Tool & Engrg. Co., 8389 So. Chicago Ave., Chicago, Ill.
Jacobs Mfg. Co., West Hartford 10, Conn.
McCrosky Tool Corp., Meadville, Pa.
Scully-Jones & Co., 1906 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.

CHUCKS, Ring Wheel

Gardner Mch. Co., 414 E. Gardner St., Beloit, Wis.

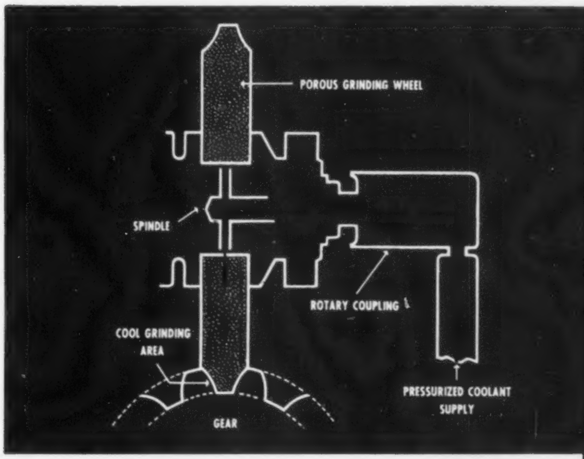
CHUCKS, Tapping

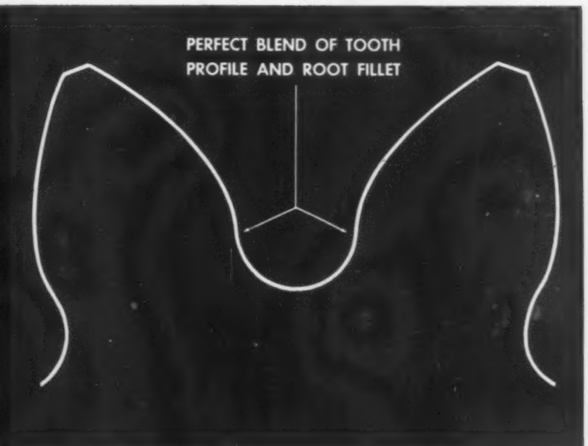
DoAll Co. 254 N. Laurel Ave., Des. Plaines, Ill.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, Staten Island, N. Y.
Jacobs Mfg. Co., West Hartford, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

(Continued on page 284)

These Unique Features

MAKE PRECISION GRINDING OF GEARS MORE PROFITABLE THAN EVER BEFORE





NON-TEMPERED, CASE-HARDENED GEARS

A controlled flow of coolant through the grinding wheel is supplied to the area between the grinding wheel and the gear tooth. This feature, coupled with the automatic down feed, virtually eliminates surface tempering and grinding checks.

PERFECT BLENDING OF FILLET AND PROFILE

Single or double diamond trimmers are used to assure a perfect blend between the tooth profile and the root fillet. This eliminates stress risers at the critical section of the tooth.

Pratt & Whitney's J-57 Turbojet: The most powerful aircraft production engine in the world is rated in the 10,000-pound thrust class.

19 Gear Grind Machines are used in the production of the Pratt & Whitney J-57

At Pratt & Whitney Aircraft, where finest quality gears and high production are essential to the manufacture of the J-57 Turbojet, 19 new automatic Gear Grind Machines are in daily use. Here is what Pratt & Whitney has to say:

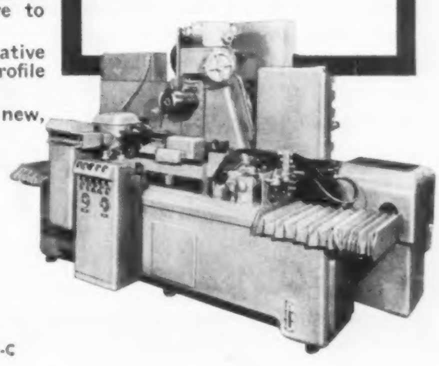
"The new Gear Grind Machines presently used in the aircraft engine division are the first major development in this type of machine since their use at Pratt & Whitney. They were developed in cooperation with Pratt & Whitney engineers to meet the specific and exacting requirements of modern aircraft engine gears. These machines are equipped with a new wheel-trimming feature and a two-speed spindle drive to eliminate burning.

"Another advantage is the relative ease with which the involute profile can be modified."

Write today for Gear Grind's new, comprehensive brochure.

These Advanced Features Are Also Available:

- Simplified modification of the involute gear tooth profile.
- Automatic trimming of the grinding wheel assures uniformly accurate work.
- Available as fully automatic machines incorporating automatic loading and unloading.



THE GEAR GRINDING MACHINE COMPANY

3921 CHRISTOPHER, DETROIT 11, MICHIGAN

Manufacturers of:
The Detroit Screwmatic 750, Automatic Screw Machine.
RZEPPA ("Sheppa") Constant Velocity Universal Joints.

56-C

For more information fill in page number on Inquiry Card, on page 225

CHUCKS, Universal Three-Jaw

Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Delta Power Tool Div., 400 Lexington Ave., Pittsburgh 8, Pa.
Gisholt Mch. Co., Madison 10, Wis.
Homestrand, Inc., Larchmont, N. Y.
Horton Chuck, Windsor Locks, Conn.
Kearney & Trecker Corp., Milwaukee 14, Wis.
Logansport Mch. Co., Inc., Logansport, Ind.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.
Warner & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio

CHUCKS, Wrenchless

Gisholt Mch. Co., Madison 10, Wis.

CIRCUIT-BREAKERS

General Electric Co., Schenectady 5, N. Y.

CLAMPS, "C", Toggle, Toolmakers' Parallel—See Set-Up Equipment Spacing Equipment

CLEANERS, Metal

Houghton & Co., E. F., 303 W. Lehigh Ave., Philadelphia 33, Pa.
Oakite Products, Inc., 19 Rector St., New York, N. Y.

CLUTCHES

Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Minster Mch. Co., Minster, Ohio
Rockford Clutch Div., Rockford, Ill.
Twin Disc Clutch Co., 1361 Racine St., Racine, Wis.

COLLETS—See Chucks, Collet

COMBINATION SQUARES—See Machinists' Small Tools

COMPARATORS, Dial, Electronic and Air

DoAll Co., Des Plaines, Ill.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, L. S. Co., Athol, Mass.

COMPARATORS, Optical

DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Eastman Kodak Co., Rochester, N. Y.
Jones & Lamson Mch. Co., Springfield, Vt.
Opto-Metric Tools, Inc., 137 Varick St., New York, N. Y.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

COMPOUNDS, Cleaning—See Cleaners, Metal

COMPOUNDS, Cutting, Grinding, Metal Drawing, etc.—See Cutting and Grinding Fluids

COMPRESSORS, Air

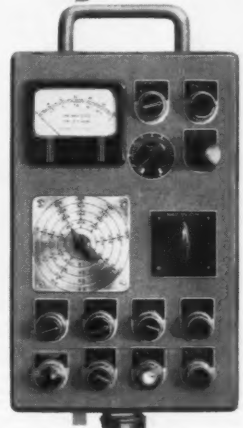
Chicago Pneumatic Tool Co., New York 17, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Wilson, K. R., Inc., Arcade, N. Y.

CONTOUR FOLLOWER—See Tracing Attachments

(*Continued on page 286*)

250-TON FORGINGS

machined with finger-tip control



Handles 250-ton forgings on centers alone while spotting for steadyrests. Swings 12 feet over the ways and takes work up to 60 feet long. Turns 14-foot tapers in one setting (with special attachment). That's the kind of performance delivered by this Betts 12-foot heavy-duty lathe.

Weighing over 240 tons, it is the heaviest, most powerful general-purpose lathe in the country. And it couldn't be easier to operate. A push-button panel mounted on the carriage enables the operator to control cutting speed with his eyes on the cut. He can change speed up or down while the tool is cutting—for maximum metal removal or optimum finish. Two big dials above the faceplate guide him, one indicating RPM, the other percentage of motor load. Exact settings are achieved faster and with greater ease than ever before.

From the same panel, the operator selects feeds. Electronically controlled, they can be adjusted in fine increments. Directional power traverse of the carriage and the toolrest are also at his finger tips.

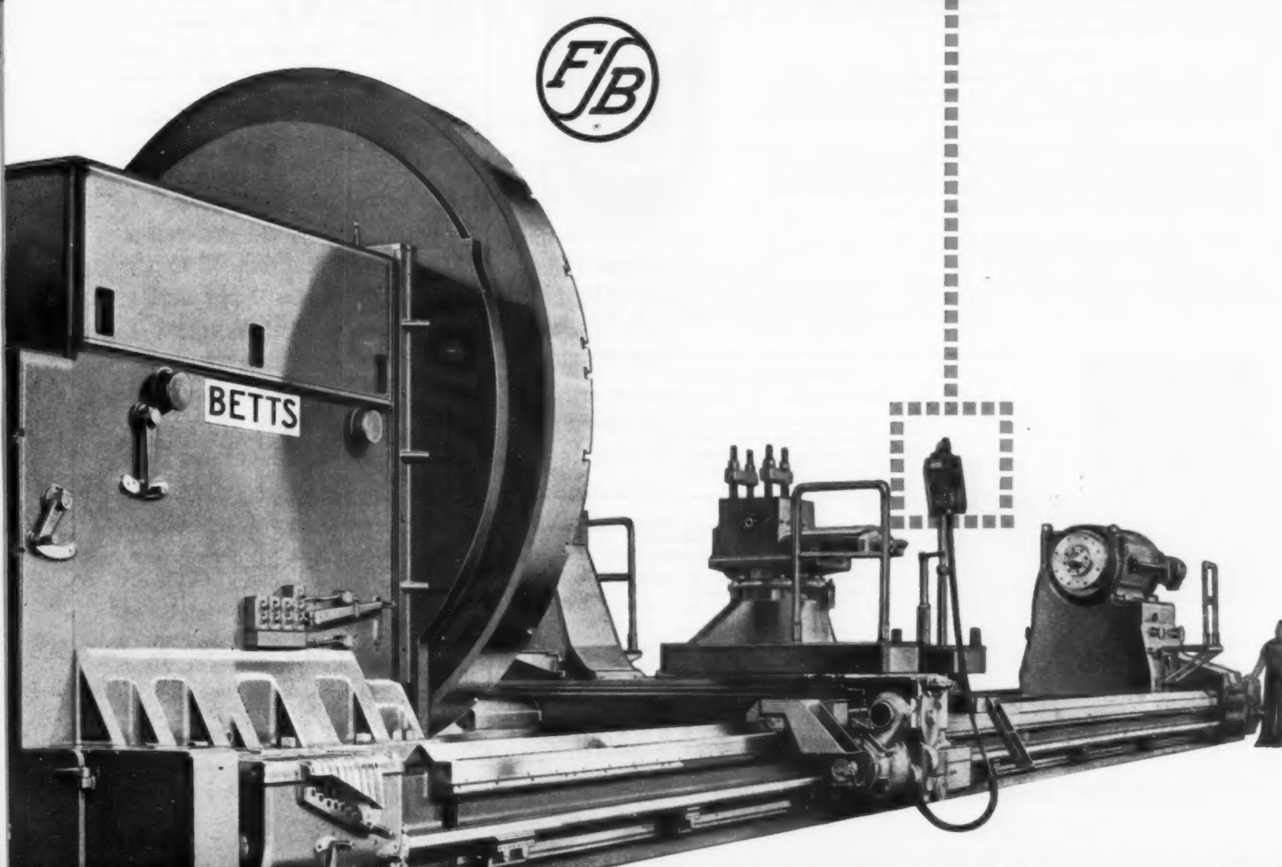
Consolidated specializes in huge, heavy-duty machine tools such as this. Why not discuss your requirements with us?

CONSOLIDATED MACHINE TOOL DIVISION

FARREL-BIRMINGHAM COMPANY, INC.

Rochester 10, N. Y.

CM-7



CONTRACT WORK

Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio
Bliss, E. W. Co., 1375 Raff Rd. S. W., Canton, Ohio
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio
Eisler Engrg. Co., 750 S. 13th St., Newark 3, N. J.
Erie Foundry Co., Erie, Pa.
Kearney & Trecker Corp., Milwaukee 14, Wis.
Lake Erie Engrg. Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Michigan Drill Head Co., Van Dyke, Mich.
National Acme Co., 170 E. 131st St., Cleveland, Ohio
Van Keuren Co., Watertown, Mass.

CONTROLLERS

Allen-Bradley Co., 1331 S. 1st St., Milwaukee, Wis.
Doelcam Div., Minneapolis-Honeywell, 1400 Soldier Field Rd., Boston 25, Mass.
General Electric Co., Schenectady, N. Y.

CONVEYORS FOR DUST, CHIPS, ETC.

Barnes, W. F. & John Co., Rockford, Ill.
Indiana Commercial Filters Corp., 28 South Ave., Lebanon, Ind.

COPPER

American Brass Co., 25 Broadway, New York, N. Y.
Mueller Brass Co., Port Huron 35, Mich.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

COUNTERBORES AND COUNTERSINKS

Besly-Welles Corp. 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Circular Tool Co., Inc., 765 Allens Ave., Providence 5, R. I.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio
DoAll Co., Des Plaines, Ill.
Eclipse Counterbore Co., 1600 Bonner Ave., Detroit 20, Mich.
Ex-Cell-O Corp., 120 Oakman Blvd., Detroit 32, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York
Heller Tool Co., Newcomerstown, Ohio
National Twist Drill & Tool Co., Rochester, Mich.
Scully-Jones & Co., 1906 Rockwell St., Chicago 8, Ill.
Star Cutter Co., 34500 Grand River, Farmington, Mich.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mass.

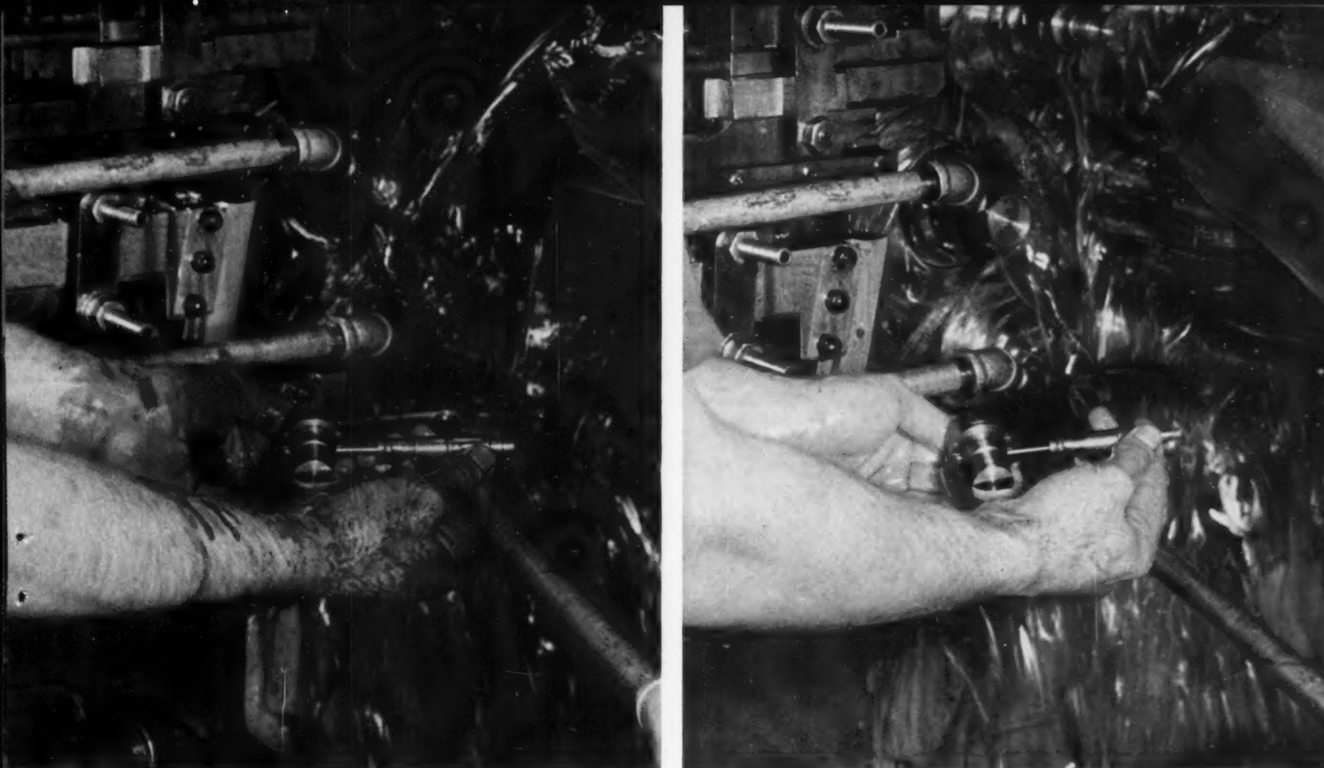
COUNTERS

Brown & Sharpe Mfg. Co., Providence, R. I.
Starrett, The L. S., Co., Athol, Mass.

COUPLINGS

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Boston Gear Works, 14 Hayward St., Quincy 71, Mass.
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Mueller Brass Co., Port Huron, Mich.
Philadelphia Gear Works, Erie Ave., and G St., Philadelphia, Pa.
Schrader's Sons, A., 470 Vanderbilt Ave., Brooklyn 38, N. Y.
Standard Pressed Steel Co., Jenkintown, Pa. (Shaft)
Thor Power Tool Co., 175 N. State St., Aurora, Ill.
Twin Disc Clutch Co., Racine, Wis.
Walker Co., Inc., O. S., Rockdale St., Worcester, Mass.

(Continued on page 288)



Black cutting oil (left) makes close control difficult. Operators dislike dirty operating conditions it creates. Close control is easier and workers are happier with transparent Sunicut cutting oil (right).

WHY USE A BLACK CUTTING OIL WHEN YOU DON'T NEED IT?

Sunicut oils give you better visibility without sacrificing machining efficiency.

When trying to maintain close control over machines producing precision parts, operators can be handicapped by "black-oil blindness". It is hard to see the tools, the workpiece, and the finishes. Checking close tolerances is difficult when the graduations on micrometers and gauges are obscured.

Worse still, as the operator sees it, are the dirty working conditions caused by dark oils. His clothes get saturated with hard-to-remove stains, and his hands are black from one end of the shift to the other.

Transparent Sunicut oils help keep your operators happy and will make close control easier ...and transparent Sunicut oils will do the job with no sacrifice in machining speed or finishes.

To get the full story on Sunicut oils, see your local Sun representative, or write Sun Oil Company, Philadelphia 3, Pa., Dept. I-41.

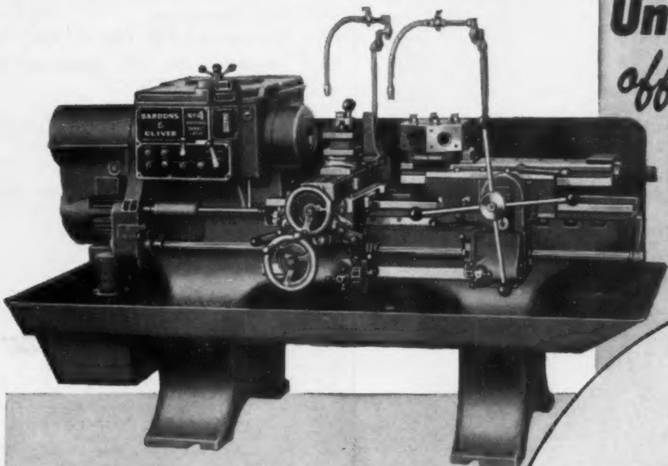
SUNOCO ®

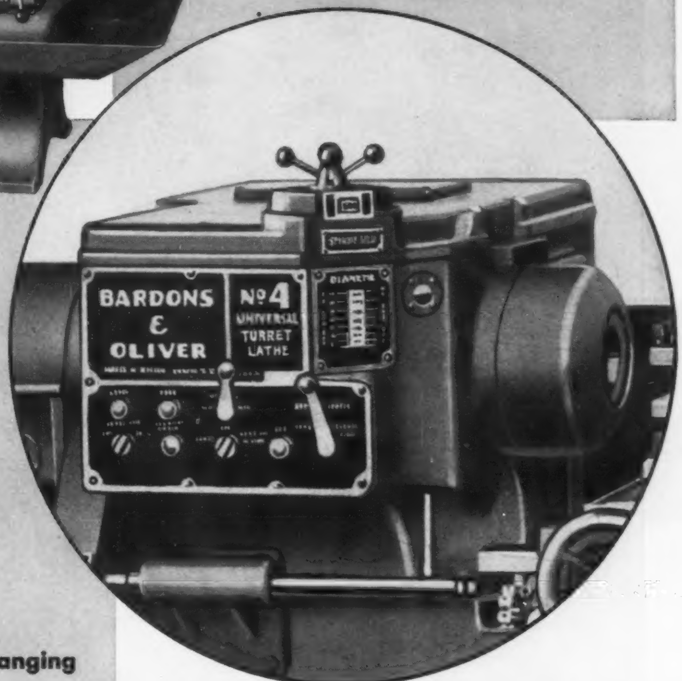
INDUSTRIAL PRODUCTS DEPARTMENT

SUN OIL COMPANY PHILADELPHIA 3, PA.

IN CANADA: SUN OIL COMPANY LIMITED, TORONTO AND MONTREAL

The BARDONS & OLIVER No. 4 Universal Turret Lathe *offers these outstanding* HEADSTOCK *Features*





- Sixteen geared spindle speeds, providing a fifty to one speed range
- Optional spindle speed ranges with maximum up to 2000 R.P.M.
- Constant horsepower (optional to fifteen) at all spindle speeds
- Fast operating and effortless electric headstock clutches
- Fully automatic spindle speed changing in less than two seconds
- Minimum number of gears in mesh at higher spindle speeds
- All anti-friction bearings
- Flanged type motor mounting
- All headstock gears of alloy steel, flame hardened and precision finished
- Headstock shafts of alloy steel, heat treated, ground-in-spline, of large diameter and short span between bearings
- All rotating assemblies statically and dynamically balanced
- Cool, filtered lubricating oil pumped to all headstock bearings, gears and clutches from separate reservoir in the head-end leg

The complete line of Bardons & Oliver Turret Lathes offers many outstanding features. Write us on your company letterhead for specific model information or send your blue prints for a proposal.

MANUFACTURERS OF A COMPLETE LINE OF TURRET LATHES AND CUTTING-OFF LATHES

BARDONS & OLIVER, INC.

1135 WEST 9TH STREET • CLEVELAND 13, OHIO

For more information fill in page number on Inquiry Card, on page 225

CRANES, Electric Traveling
Cleveland Crane & Engrg. Co., Wickliffe, Ohio

CUTTERS, Keyseating
Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio
Davis Keyseater Co., 405 Exchange St., Rochester 8, N. Y.
DoAll Co., Des Plaines, Ill.
du Mont Corp., Greenfield, Mass.
Mitts & Merrill, 1009 So. Water St., Saginaw, Mich.
National Twist Drill Co., Rochester, Mich.
Star Cutter Co., 34500 Grand River, Farmington, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

CUTTERS, Milling
Apex Tool & Cutter Co., Inc., 235 Canal St., Shelton, Conn.
Barber-Colman Co., 1300 Rock St., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio
DoAll Co., Des Plaines, Ill.
Eclipse Counterbore Co., 1600 Bonner Ave., Detroit 20, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Goddard & Goddard Co., Detroit, Mich.
Gorton, George, Mch. Co., 1321 Racine St., Racine, Wis.
Haynes Stellite Co., Kokomo, Ind.
Kearney & Trecker Corp., Milwaukee, Wis.
Kennametal, Inc., Latrobe, Pa.
McCrosky Tool Corp., Meadville, Pa.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Motch & Merryweather Mchry Co., Penton Bldg., Cleveland, Ohio
National Twist Drill & Tl. Co., Rochester, Mich.
Star Cutter Co., 34500 Grand River, Farmington, Mich.
Tomkins-Johnson Co., Jackson, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

CUTTING AND GRINDING FLUIDS
Cincinnati Milling Products Div., Cincinnati, Ohio
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Cities Service Oil Co., 70 Pine St., New York, N. Y.
DoAll Co., Des Plaines, Ill.
Houghton, E. F. & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Motch & Merryweather Mchy. Co., Penton Bldg., Cleveland 3, Ohio
Oakite Products, Inc., 26 Rector St., New York 6, N. Y.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Sinclair Refining Co., 600 Fifth Ave., New York, N. Y.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.

CUTTING-OFF MACHINES, Lathe Type
Bardons & Oliver, Inc., 1133 West Ninth St., Cleveland 13, Ohio
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio
Cone Automatic Mch. Co., Windsor, Vt.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Grieder Industries, Inc., Bowling Green, Ohio
Modern Machine Tool Co., Jackson, Mich.

CUTTING-OFF SAWS, Abrasive Wheel
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh, Pa.
DoAll Co., Des Plaines, Ill.
Johnson Mfg. Co., Albion, Mich.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Simonds Abrasive Co., Tacony & Fraley Sts., Philadelphia 35, Pa.

(*Continued on page 290*)

For more information fill in page number on Inquiry Card, on page 225

CUTTING TOOLS—See Tool Material

CYLINDERS, Air
Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Hannifin Corp., 501 Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mt. Gilead, Ohio
Logansport Mch. Co., Inc., Logansport, Ind.
Tomkins-Johnson Co., Jackson, Mich.

CYLINDERS, Hydraulic
Barnes, John S., Corp., 301 S. Water St., Rockford, Ill.
Chicago Pneumatic Tool Co., New York 17, N. Y.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mt. Gilead, Ohio
Logansport Machine Co. Inc., Logansport, Ind.
National Forge & Ordnance Co., Irvine, Warren County, Pa.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Vickers, Inc., Detroit 32, Mich.
Wilson, K. R., Inc., Arcade, N. Y.

DEBURRING MACHINES
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Modern Industrial Eng. Co., 14230 Birwood Ave., Detroit 38, Mich.
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland 14, Ohio
Sheffield Corp., Box 893, Dayton 1 Ohio
Sunnen Products Co., 7910 Manchester, St. Louis 17, Mo.

DEMAGNETIZERS
Blanchard Mch. Co., 64 State St., Cambridge, Mass.

DIE CASTINGS—See Casting, Die

DIE-CASTING MACHINES
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Engineering Corp., 470 Woodward Ave., Buffalo, N. Y.

DIE CUSHIONS
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Clearing Mch. Corp., 6499 W. 65th St., Chicago, Ill.
Danly Mch. Specialties, Inc., 2100 S. Laramie, Chicago 50, Ill.
Federal Machine & Welder Co., Overland Ave., Warren, Ohio
Minster Mch. Co., Minster, Ohio
Verson Allsteel Press Co., 93rd St., and S. Kenwood Ave., Chicago, Ill.

DIEING MACHINES
Pratt & Whitney Co., Inc., West Hartford, Conn.

DIE INSERTS, Carbide
Allegheny Ludlum Steel Corp., Pittsburg, Pa.
Kennametal Inc., Latrobe, Pa.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.

DIE SETS AND DIEMAKERS' SUPPLIES
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Danly Mch. Specialties, Inc., 2100 S. Laramie, Chicago 50, Ill.
Producto Mch. Co., 985 Housatonic Ave., Bridgeport 1, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
Wales-Strippit Co., No. Tonawanda, N. Y.

DIE SINKING MACHINES—See Milling Machines, Die Sinking, etc.

DIE STOCKS—See Stocks and Dies

DIES, Blanking, Forming, Drawing, Extruding, etc.
Bath, Cyril Co., 32324 Aurora Road, Solon, Ohio
Cincinnati Shaper Co., Hopple & Garrard, Cincinnati, Ohio
Dreis & Krump Mfg. Co., 7400 Loomis Blvd., Chicago 36, Ill.
Ferracute Mch. Co., Bridgeton, N. J.
Metal Carbides Corp., Youngstown, Ohio
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Moore Special Tool Co., Inc., 740 Union Ave., Bridgeport 7, Conn.
Niagara Mch. & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Olofsson Corp., Lansing, Mich.
Ryerson & Son, Inc., Jos. T., 16th & Rockwell Sts., Chicago 8, Ill.
Verson Allsteel Press Co., 93rd St., and S. Kenwood Ave., Chicago, Ill.
Wales-Strippit Corp., North Tonawanda, N. Y.

DIES, Lettering and Embossing
Acromark Co., 9-11 Morrell St., Elizabeth, N. J.
Wales-Strippit Corp., North Tonawanda, N. Y.

DIES, Self-opening Threading
Consolidated Mch. Tool Div., 565 Blossom Rd., Rochester 10, N. Y.
Eastern Mch. Screw Corp., New Haven, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Jones & Lamson Mch. Co., Springeld, Vt.
Landis Mch. Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio

DIES, Thread Cutting—See Stocks and Dies

DIES, Thread Rolling
Landis Machine Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio
Pratt & Whitney Co., Inc., West Hartford, Conn.
Reed Rolled Thread Die Co., P. O. Box 350, Worcester 1, Mass.

DISINTEGRATORS
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio.
Elox Corp., Royal Oak 3, Mich.

DIVIDERS AND TRAMMELS—See Layout and Drafting Tools

DIVIDING HEADS—See Indexing and and Spacing Equipment

DOWEL PINS
Allen Mfg. Co., 133 Sheldon St., Hartford 2, Conn.
Danly Mch. Specialties, Inc., 2100 S. Laramie, Chicago 50, Ill.
DoALL Co., Des Plaines, Ill.
Producto Machine Co., 985 Housatonic Ave., Bridgeport, Conn.
Standard Pressed Steel Co., Jenkintown, Pa.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

(*Continued on page 292*)

DRAWING COMPOUNDS

Oakite Products, Inc., 26 Rector St., New York 6.

DRESSERS, Grinding Wheel

Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Colonial Broach & Machine Co., P. O. Box 37, Harper St., Detroit 13, Mich.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio.
Metal Carbides Corp., Youngstown, Ohio.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn.
Norton Co., 1 New Bond St., Worcester, Mass.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.

DRIFT KEYS

Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
DoALL Co., Des Plaines, Ill.
Scully-Jones & Co., 1906 S. Rockwell St., Chicago 8, Ill.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILL SLEEVES AND EXTENSION HOLDERS

Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
DoALL Co., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Automatic Tool Co., Richmond, Ind.
National Twist & Tool Co., Rochester, Mich.
Scully-Jones & Co., 1906 S. Rockwell St., Chicago 8, Ill.

DRILL HEADS, Multiple Spindle

Atlas Press Co., 20108 N. Pitcher, Kalamazoo, Mich.
Avey Drilling Machine Co., 25 East Third St., Covington, Ky.
Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Baush Machine Tool Co., 15 Wason Ave., Springfield, Mass.
Buffalo Forge Co., Broadway, Buffalo, N. Y.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Davis & Thompson Co., 4460 N. 124th St., Milwaukee 10, Wis.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh, Pa.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, Staten Island, N. Y.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn, N. Y.
Kearney & Trecker Corp., Milwaukee 14, Wis.
LaSalle Tool, Inc., 3840 E. Outer Dr., Detroit 34, Mich.
Leland Gifford Co., Box 989, Worcester 1, Mass.
Michigan Drill Head Co., Van Dyke, Mich.
National Automatic Tool Co., Richmond, Ind.
Snyder Tool & Engrg. Co., 3400 Lafayette, Detroit 7, Mich.
Thriftmaster Products Corp., 1076 N. Plum St., Lancaster, Pa.
United States Drill Head Co., 616 Burns, Cincinnati, Ohio
Zagar, Inc., 2400 Lakeland Blvd., Cleveland 23, Ohio

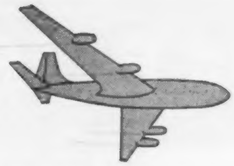
DRILL HEADS, Unit Type

Barnes Drill Co., 814 Chestnut, Rockford, Ill
Delta Power Tool Div., Rockwell Mfg. Co. Pittsburgh, Pa.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford 12, Conn.
Kingsbury Mch. Tool Corp., Keene, N. H.
Michigan Drill Head Co., Detroit 34, Mich
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Morris Machine Tool Co., Inc., 946-H Harriet St., Cincinnati 3, Ohio.
Rehnberg-Jacobson Mfg. Co., 2135 Kiswaukee St., Rockford, Ill.
Snow Manufacturing Co., Bellwood, Illinois

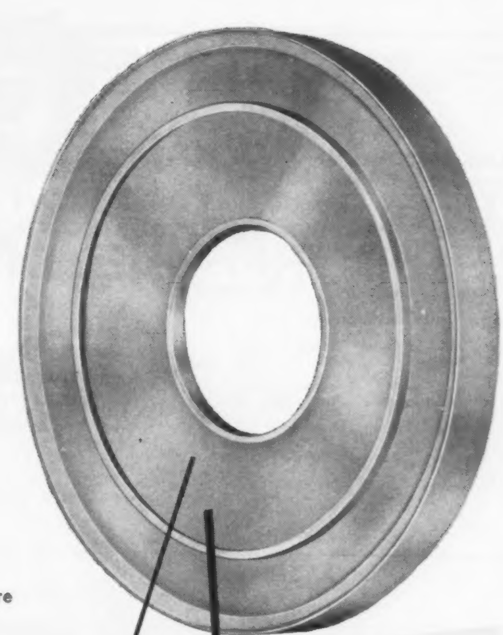
DRILLING AND BORING UNITS, Self-contained

Avey Drilling Machine Co., 25 East Third St., Covington, Ky.
Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio
Barnes, W. F. & John Co., Rockford, Ill.
Baush Machine Tool Co., 15 Wason Ave., Springfield, Mass.
Buhr Machine Tool Co., 839 Green St., Ann Arbor, Mich.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Govro-Nelson Co., 1931 Antoinette St., Detroit 8, Mich.
Homestrand, Inc., Larchmont, N. Y.
Kearney & Trecker Corp., Milwaukee 14, Wis.
LaSalle Tool, Inc., 3840 E. Outer Dr., Detroit 34, Mich.
Leland-Gifford Co., Box 989, Worcester 1, Mass.
Michigan Drill Head Co., Van Dyke, Mich.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio
National Automatic Tool Co., S. 7th and N. Sts., Richmond, Ind.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Sheffield Corp., Box 893, Dayton 1, Ohio
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit, Mich.

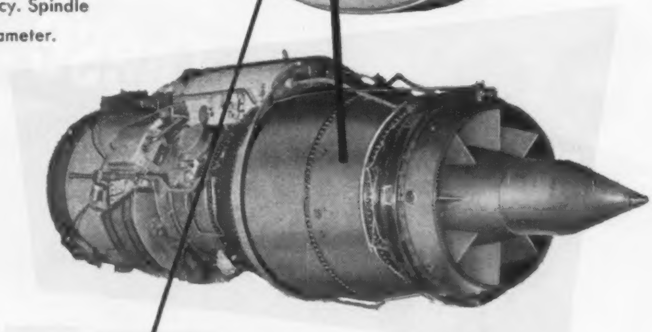
(Continued on page 294)

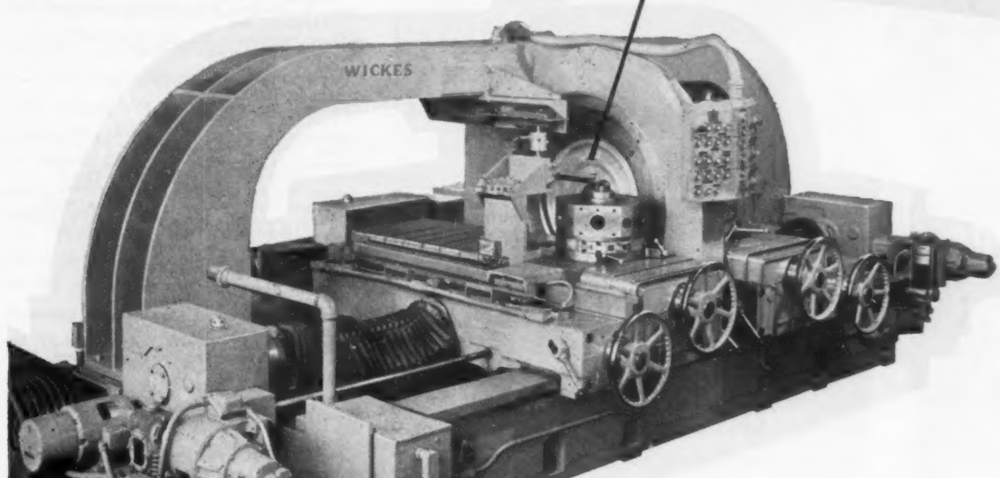


both sides of turbo-jet engine discs profile-faced simultaneously with new WICKES center drive facing lathe



The Wickes CDF Series Machines represent a new concept in machining that offers advantages never before possible. Equalized pressure of cutting tools on opposite sides makes for extreme accuracy. Spindle speed control for constant surface speed at any pick-off diameter. Six machine sizes available for machining discs ranging in diameter from 14″ to 44″. Constant cutting feet per minute plus uniform feed per revolution produce a highly superior finish. Single chucking eliminates stack up of tolerances. Stainless steel or titanium readily machined. Controlled by 360° tracer. Developed by the pioneers of the center drive principle . . . proved in actual operation. For more detailed information on this machine write us today.





WICKES

MACHINE TOOL DIVISION

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92

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DRILLING MACHINES, Automatic

Avey Drilling Machine Co., 25 East Third St., Covington, Ky.
Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John Co., Rockford, Ill.
Baush Machine Tool Co., 15 Wason Ave., Springfield, Mass.
Bodine Corp., 317 Mt. Grove St., Bridgeport 5, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Davis & Thompson Co., 4460 N. 124th St., Milwaukee 10, Wis.
Edlund Mchry. Co. Div., Cortland, N. Y.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Kearney & Trecker Corp., Milwaukee 14, Wis.
Kingsbury Mch. Tool Corp., Keene, N. H.
LaSalle Tool, Inc., 3840 E. Outer Dr., Detroit 34, Mich.
Leland-Gifford Co., Box 989, Worcester 1, Mass.
Michigan Drill Head Co., Van Dyke, Mich.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Modern Industrial Eng. Co., 14230 Birwood Ave., Detroit 38, Mich.
Moline Tool Co., Moline, Ill.
Morris Machine Tool Co., 946-M Harriet St., Cincinnati 3, Ohio
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Olofsson Corp., Lansing, Mich.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Snow Manufacturing Co., Bellwood, Ill.
Townsend, H. P., Mfg. Co., Elmwood, Conn.
Wales-Strippit Corp., North Tonawanda, N. Y.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio

DRILLING MACHINES, Bench

Atlas Press Co., 20108 N. Pitcher, Kalamazoo, Mich.
Avey Drilling Machine Co., 25 East Third St., Covington, Ky.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Cincinnati Lathe & Tool Co., Marburg Ave., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh, Pa.
Edlund Machinery Co. Div., Cortland, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio
Leland-Gifford Co., Box 989, Worcester, Mass.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

DRILLING MACHINES, Deep Hole

Avey Drilling Machine Co., 25 East Third St., Covington, Ky.
Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio
Baush Machine Tool Co., 15 Wason Ave., Springfield, Mass.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Krueger-Barnes Corp., 1469 E. Grand Blvd., Detroit 11, Mich.
Leland-Gifford Co., Box 989, Worcester 1, Mass.
Michigan Drill Head Co., Van Dyke, Mich.
Morris Mch. Tool Co., 946-M Harriet St., Cincinnati 3, Ohio
National Automatic Tool Co., Inc., S. 7th and N. St., Richmond, Ind.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Wales-Strippit Corp., North Tonawanda, N. Y.

DRILLING MACHINES, Gang, Multiple-spindle

Avey Drilling Machine Co., 25 East Third St., Covington, Ky.
Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John Co., Rockford, Ill.
Baush Machine Tool Co., 15 Wason Ave., Springfield, Mass.
Bodine Corp., 317 Mt. Grove St., Bridgeport 5, Conn.
Cincinnati Bickford Div., Oakley, Cincinnati, Ohio
Consolidated Mch. Tool Corp., Rochester, N. Y.
Davis & Thompson Co., 4460 124th St., Milwaukee 10, Wis.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh, Pa.
Edlund Machinery Co. Div., Cortland, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland, Ohio
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio
Greenlee Bros. & Co., 2136 12th St., Rockford, Ill.
Hamilton Tool Co., 834 So. 9th St., Hamilton, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Leland-Gifford Co., Box 989, Worcester, Mass.
Michigan Drill Head Co., Van Dyke, Mich.
Modern Industrial Eng. Co., 14230 Birwood Ave., Detroit 38, Mich.
Moline Tool Co., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
South Bend Lathe Works, South Bend 22, Ind.
Western Machine Tool Works, Holland, Mich.

DRILLING MACHINES, Radial

American Tool Works Co., Pearl and Eggleston Ave., Cincinnati, Ohio
Carlton Mch. Tool Co., 2961 Meeker St., Cincinnati 25, Ohio
Cincinnati Bickford Div., Oakley, Cincinnati, Ohio
Cincinnati Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio
Cincinnati Lathe & Tool Co., Marburg Ave., Cincinnati 9, Ohio
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland, Ohio
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio

(Continued on page 296)

Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Western Machine Tool Works, Holland, Mich.

DRILLING MACHINES, Sensitive

Atlas Press Co., 20108 N. Pitcher, Kalamazoo, Mich.
Avey Drilling Machine Co., 25 East Third St., Covington, Ky.
Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Cincinnati Bickford Div., Oakley, Cincinnati, Ohio
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh, Pa.
Edlund Machinery Co. Div., Cortland, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland 8, Ohio
Fosdick Mch. Tool Co., 1638 Blue Rock St., Cincinnati 23, Ohio
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio
Leland-Gifford Co., Box 989, Worcester, Mass.
Levin & Son, Inc., Louis, 3610 So. Broadway, Los Angeles 7, Calif.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Snow Manufacturing Co., Bellwood, Illinois
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Townsend, H. P., Mfg. Co., Elmwood, Conn.
Wales-Strippit Corp., North Tonawanda, N. Y.
Western Machine Tool Works, Holland, Mich.

DRILLING MACHINES, Upright

Avey Drilling Machine Co., 25 East Third St., Covington, Ky.
Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio
Barnes, W. F. & John Co., Rockford, Ill.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Cincinnati Bickford Div., Oakley, Cincinnati, Ohio
Cincinnati Lathe & Tool Co., Marburg Ave., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York, 17, N. Y.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio
Homestrand, Inc., Larchmont, N. Y.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Michigan Drill Head Co., Van Dyke, Mich.
National Automatic Tool Co., Inc., S. 7th and N. St., Richmond, Ind.
Rehnberg-Jacobson Mfg. Co., 2135 Kishwaukee St., Rockford, Ill.
Snow Manufacturing Co., Bellwood, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Wales-Strippit Corp., North Tonawanda, N. Y.
Western Machine Tool Works, Holland, Mich.

DRILLS, Center

Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Circular Tool Co., Inc., 765 Allens Ave., Providence 5, R. I.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio
DoALL Co., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Core

Ace Drill Corp., Adrian, Mich.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio
DoALL Co., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
National Twist Drill & Tl. Co., Rochester, Mich.
Scully-Jones & Co., 1906 Rockwell St., Chicago 8, Ill.
Star Cutter Co., 34500 Grand River, Farmington, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Deep Hole, Gun

Ace Drill Corp., Adrian, Mich.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago 10, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tl. Co., Rochester, Mich.
Star Cutter Co., Farmington, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Oil Hole, Oil Tube

Besly-Welles Corp., 112 Dearborn Ave., South Beloit, Ill.
Chicago-Latrobe Twist Drill Wks., 411 W. Ontario St., Chicago 10, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio
DoALL Co., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tl. Co., Rochester, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Portable Electric

Chicago Pneumatic Tool Co., New York 17, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Thor Power Tool Co., Aurora, Ill.

DRILLS, Portable Pneumatic

Chicago Pneumatic Tool Co., New York 17, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Thor Power Tool Co., Aurora, Ill.

DRILLS, Rachet

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Subland

Ace Drill Corp., Adrian, Mich.
Besly-Welles Corp., 112 Dearborn Ave., South Beloit, Ill.
Chicago-Latrobe Twist Drill Wks., 411 W. Ontario St., Chicago 10, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio
DoALL Co., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Star Cutter Co., 34500 Grand River, Farmington, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Twist, High-Speed Steel, Carbon Steel

Ace Drill Corp., Adrian, Mich.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio

(Continued on page 298)

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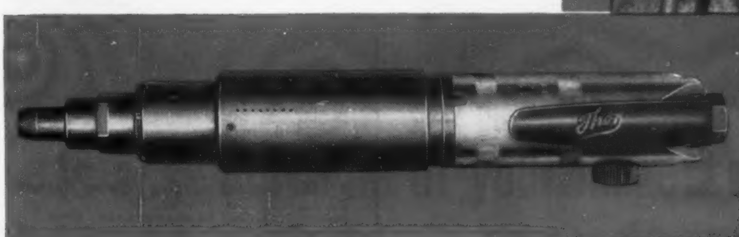
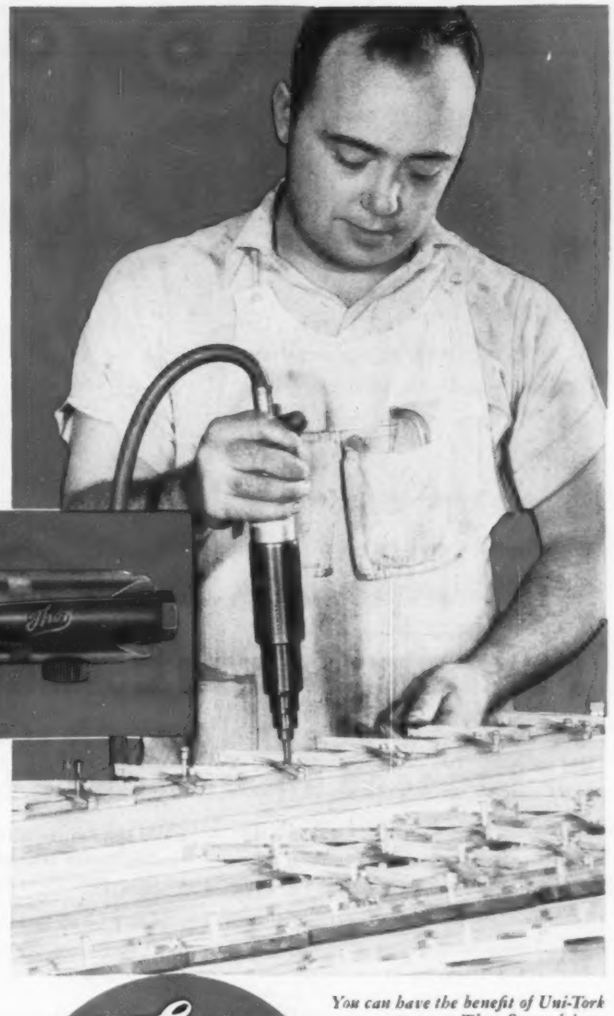
Air and Electric Screwdrivers and Nutsetters

For *Uniform Torque* control of threaded fasteners





THOR, pioneer of so many industrial tools, inventor of the automatic screwdriver, has done it again! New Thor Uni-Tork Screwdrivers and Nutsetters completely eliminate operator judgment in the precision driving of threaded fasteners!

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Kansas City, Mo. • Los Angeles
Milwaukee • Newark
Long Island City, N.Y. • Philadelphia
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San Francisco • Seattle
Toronto, Canada
Export Division, New York City

DoAll Co., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Thor Power Tool Co., 175 N. State St., Aurora, Ill.
Threadwell Tap & Die Co., 16 Arch, Greenfield, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Twist, Carbide, Carbide-tipped
Ace Drill Corp., Adrian, Mich
Allegheny Ludlum Steel Corp., Oliver Bldg., Pittsburgh 22, Pa.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio
DoALL Co., Des Plaines, Ill.
Heller Tool Co., Newcomerstown, Pa.
National Twist Drill & Tool Co., Rochester, Mich.
Thor Power Tool Co., 175 N. State St., Aurora, Ill.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Wire
Ace Drill Corp., Adrian, Michigan.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DUPLICATING ATTACHMENTS—See Tracing Attachments

DUST COLLECTORS AND CONTROL SYSTEMS
Brown & Sharpe Mfg. Co., Providence, R. I.
Pangborn Corp., Hagerstown, Md.
Standard Electrical Tool Co., 2500 River Rd., Cincinnati 14, Ohio

ELECTRICAL DISCHARGE MACHINES
—See Disintegrators

ENGRAVING MACHINES
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gorton, Geo., Mach., 1321 Racine St., Racine, Wis.

EXTRACTORS, Screw
Chicago-Latrobe Twist Drill Wks., 411 W. Ontario St., Chicago 10, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio
Greenfield Tap & Die Corp., Greenfield, Mass.
Williams & Co., J. H., 400 Vulcan St., Buffalo 7, N. Y.

FACING HEADS
Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Davis Boring Tool Div., Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Michigan Drill Head Co., Van Dyke, Mich.
Mummert-Dixon Co., Hanover, Pa.

FANS, Exhaust, Ventilating
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.

FELT, For All Applications
American Felt Co., Glenville, Conn.

FILES, Band
DoALL Co., Des Plaines, Ill.

FILES, General-purpose, Swiss Pattern
DoALL Co., Des Plaines, Ill.
Heller Tool Co., Newcomerstown, Ohio
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.

FILES AND BURRS, Rotary
DoALL Co., Des Plaines, Ill.
Heller Tool Co., Newcomerstown, Ohio
Pratt & Whitney Co., Inc., West Hartford, Conn.
Simonds Saw & Steel Co., Fitchburg, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

FILING MACHINES
Chicago Pneumatic Tool Co., New York 17, N. Y.
DoAll Co., Des Plaines, Ill.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

FILTERS, Coolant and Oil
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Commercial Filters Corp., Lebanon, Ind.
DeLaval Separator Co., Poughkeepsie, N. Y.
Indiana Commercial Filters Corp., 28 South Ave., Lebanon, Ind.
Industrial Filtration Co., 15 Industrial Ave., Lebanon, Ind.
Marvel Engineering Co., 7227 N. Hamlin Ave., Chicago 45, Ill.

(Continued on page 300)

FINISHES, Machine and Metal
Lowe Bros. Co., Dayton, Ohio

FLAME-HARDENING MACHINES
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Gleason Works, 1000 University Ave., Rochester 3, N. Y.

FORGING HAMMERS, Steam and Air
Chambersburg Engrg. Co., Chambersburg, Pa.
Erie Foundry Co., Erie, Pa.

FORGING, Machines, Headers, Upsetters
Ajax Mfg. Co., Euclid, Cleveland 17, Ohio
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio

FORGINGS, Drop
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Crucible Steel Co. of America, Henry W. Oliver Bldg., Mellon Square, Pittsburgh 22, Pa.
Mueller Brass Co., Port Huron 35, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

FORGINGS, Hollow-Bored
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Mueller Brass Co., Port Huron, Mich.
National Forge & Ordnance Co., Irvine, Warren County, Pa.

FORGINGS, Press
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Bridgeport Brass Co., Bridgeport, Conn.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Farquhar Div., A. B., 142 N. Duke St., York, Pa.
Minster Mch. Co., Minster, Ohio
Mueller Brass Co., Port Huron, Mich.
National Forge & Ordnance Co., Irvine, Warren County, Pa.
Revere Copper & Brass, Inc., 230 Park Ave., New York 17, N. Y. (die-pressed)
U. S. Steel Corp., Pittsburgh, Pa.

FORGINGS, Upset
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
New Departure Div., Bristol, Conn.
Vanadium-Alloys Steel Co., Latrobe, Pa.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

FORMING MACHINES, Cold-rolling
Cincinnati Milling Machine Co., Process Machinery Div., Cincinnati 9, Ohio
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Eng. Corp., 470 Woodward Ave., Buffalo, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Niagara Mch. & Tool Works, 637 Northland Ave., Buffalo, N. Y.
Yoder Co., 5500 Walworth, Cleveland, Ohio

FORMING MACHINES, Multiple-slide
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Baldwin-Lima-Hamilton Corp., Lima-Hamilton Div., Hamilton, Ohio
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Chambersburg Engrg. Co., Chambersburg, Pa
Clearing Machine Corp., 6499 W. 65 St., Chicago 38, Ill.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

FORMING TOOLS or Tool Blanks
Brown & Sharpe Mfg. Co., Providence, R. I.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametal, Inc. Latrobe Pa
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich

FURNITURE, Shop
Standard Pressed Steel Co., Jenkintown, Pa

GAGE BLOCKS
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill
Pratt & Whitney Co., Inc., West Hartford Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

GAGES, Air Comparator
Federal Products Corp., 1144 Eddy St., Provi-
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., Box 893, Dayton 1, Ohio

GAGES, Automatic Sorting
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.

GAGES, Dial, Bore, Height, Depth, Thread, Groove, etc.
Ames, B. C., Co., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bryant Chucking Grinder Co., Clinton St., Springfield, Vt.
Comtor Co. 47 Farwell St. Waltham 54 Mass.
DoALL Co., Des Plaines, Ill.
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Standard Gage Co. Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.

GAGES, Electric Comparator
Brown & Sharpe Mfg. Co., Providence, R. I.
DoALL Co., Des Plaines, Ill.
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
General Electric Co., Schenectady, N. Y.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Sheffield Corp., Box 893, Dayton 1, Ohio

GAGES, Grinding
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.

GAGES, Machinists' Hand, including Center, Cutter Clearance, Drill Point, Drill Size, Planer, Radius, Screw Pitch, Taper, Telescoping Thickness
Brown & Sharpe Mfg. Co., Providence, R. I.

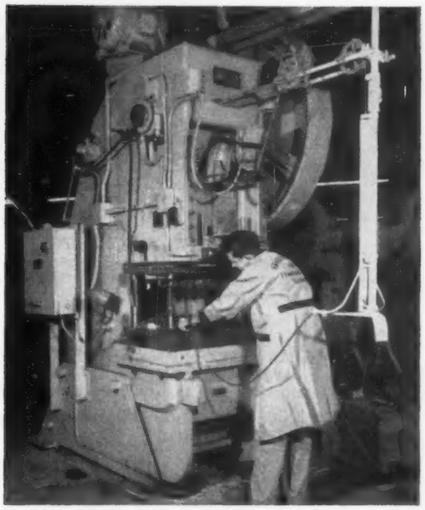
(*Continued on page 302*)

From caddy carts . . to cameras . .

Warco®

QUALITY PAYS OFF

Below—Robert Lonze, partner in Era Tool & Engineering, and Raymond Heldt, plant superintendent, looking over a scale case that has just been shaped on the Warco 150 ton Straight Side Press in background.



Leading Chicago metal fabricator likes Warco Press dependability!

"The demand for fast production of a wide variety of stampings calls for most dependable press equipment and that's why we like Warco Presses." This from Robert Lonze, partner in Era Tool & Engineering Co., of Franklin Park, Illinois, one of the Mid-West's leading metal fabricators.

"We first became acquainted with Warco during the war. The ease of operation acclaimed by our press operators, plus the extremely low maintenance requirements, were two of many outstanding features that thoroughly convinced us Warco builds rugged, practical and dependable press equipment.

"Whenever the need for an additional Press arises, we here at Era Tool will give Warco first consideration."

Federal® WELDERS

The Federal Machine Warco PRESSES® **and Welder Company**

WARREN, OHIO

For more information fill in page number on Inquiry Card, on page 225

GAGES, Multiple Inspection
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Sheffield Corp., Box 893, Dayton 1, Ohio

GAGES, Plug and Ring
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoALL Co., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., Box 893, Dayton 1, Ohio
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
Van Keuren Co., Watertown, Mass.
Winter Bros. Co., Rochester, Mich.

GAGES, Pressure, Air and Hydraulic
Modern Industrial Eng. Co., 14230 Birwood Ave., Detroit 38, Mich.

GAGES, Roll Thread Snap, Adjustable Snap
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Greenfield Tap & Die Corp., Greenfield, Mass.
Sheffield Corp., Box 893, Dayton 1, Ohio
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.

GAGES, Surface Roughness
DoALL Co., Des Plaines, Ill.
Sheffield Corp., Box 893, Dayton 1, Ohio

GAGES, Vernier, Height, Depth, Gear Tooth
Brown & Sharpe Mfg. Co., Providence, R. I.
DoALL Co., Des Plaines, Ill.
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Starrett Co., L. S., Athol, Mass.

GASKETS
Garlock Packing Co., Palmyra, N. Y.
Houghton & Co., E. F., 303 W. Lehigh Ave., Philadelphia 33, Pa.

GEAR BURNISHERS
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Sheffield Corp., Box 893, Dayton 1, Ohio

GEAR CHAMFERING, ROUNDING AND DEBURRING MACHINES
Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Modern Industrial Engrg. Co., 14230 Birwood, Detroit 4, Mich.
Sheffield Corp., Box 893, Dayton 1, Ohio

GEAR CHECKING EQUIPMENT
Brown & Sharpe Mfg. Co., Providence, R. I.
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Scherr George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEAR CUTTING MACHINES
Bevel and Spiral
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEAR CUTTING MACHINES, Worm and Worm Wheels
Barber-Colman Co., 1300 Rock St., Rockford, Ill.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Lees-Bradner Co., Cleveland, Ohio
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEAR GRINDERS—See Grinding Machines, Gear

GEAR HOBBERS
American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Barber-Colman Co., 1300 Rock St., Rockford, Ill.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fellows Gear Shaper Co., Springfield, Vt.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio
Lees-Bradner Co., Cleveland, Ohio
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.

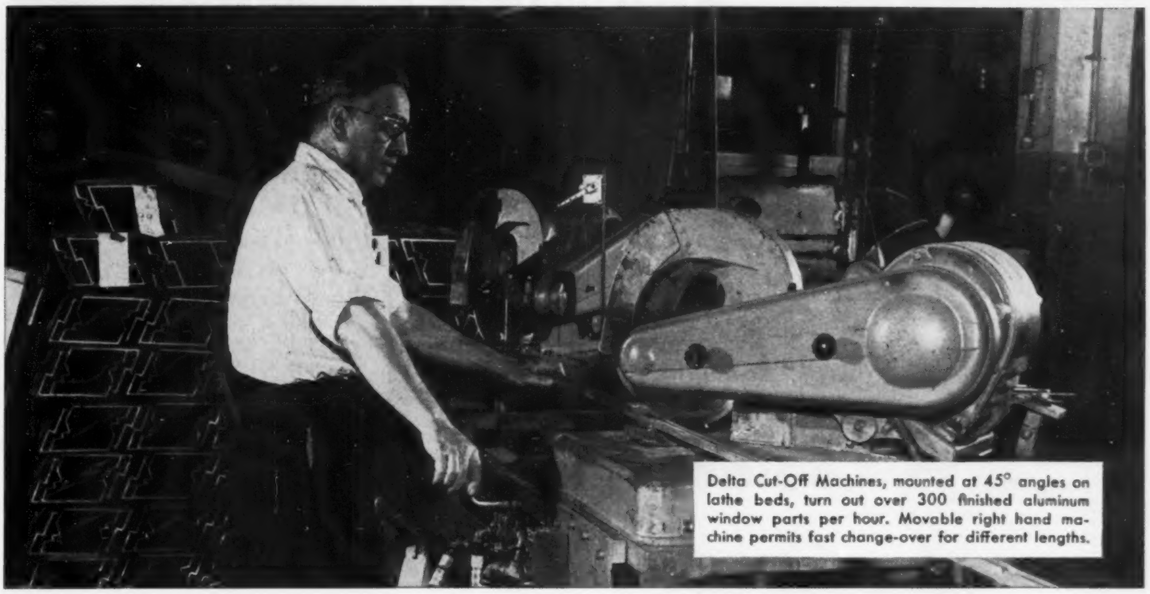
GEAR HONERS
National Broach & Mch. Co., 5600 St. Jean, Detroit 13, Mich.

GEAR LAPPERS
Fellows Gear Shaper Co., Springfield, Vt.

(Continued on page 304)

ROCKWELL-BUILT

DELTA cut-off machines



Delta Cut-Off Machines, mounted at 45° angles on lathe beds, turn out over 300 finished aluminum window parts per hour. Movable right hand machine permits fast change-over for different lengths.

...save cost of expensive special equipment

for General Bronze Corp., Garden City, L.I.

DUAL SET-UPS ARE FAST, ACCURATE—By adapting versatile Delta Cut-Off Machines to handle custom operations with limited production runs, General Bronze eliminated the need for expensive special tooling. The Delta machines give them the accuracy and fast change-over needed to turn out precision work at high speed.

COST LESS TO BUY, OPERATE—Delta Cut-Off Machines not only do precision work fast, but at far less cost. "These Delta machines have been in constant use for at least 15 years," says Joseph Gafney, plant engineer, "and they consistently give us the exacting, trouble-free operation we need."

LITTLE MAINTENANCE, FAST SERVICE—According to Mr. Gafney, the little maintenance that's been needed over the years has been done quickly and easily. "Delta salesmen have given us fast, dependable service when we've needed it," says Mr. Gafney.

SEE THE ENTIRE DELTA CUT-OFF MACHINE LINE: Wet Abrasive—Dry Abrasive—Non-Ferrous Metal, Wood. Get all the facts—compare for quality, for performance. Then make up your *own* mind! Your Delta Dealer is listed under "TOOLS" in the Yellow Pages.

Send for all the facts today!

DELTA ROCKWELL

another product by **ROCKWELL**

Delta Power Tool Division, Rockwell Manufacturing Co.
614M N. Lexington Ave., Pittsburgh 8, Pa.

☐ Please send catalog on entire Delta Cut-Off Machine line.
☐ Please send Fact Book on using Delta Power Tools teamed with machine tools.
☐ Please send name of my nearest Delta Dealer.

Name________ Title________
Company________
Address________
City________ County________ State________

For more information fill in page number on Inquiry Card, on page 225

Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean, Detroit 2, Mich.

GEAR MOTORS—See Speed Reducers

GEAR RACKS
Gear Specialties, Inc., 2635 W. Medill Ave., Chicago 47, Ill.
Illinois Gear & Mch. Co., 2108 No. Natchez Ave., Chicago 35, Ill.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Stahl Gear & Mch. Co., The, 3901 Hamilton Ave., Cleveland 4, Ohio

GEAR SHAPERS
Fellows Gear Shaper Co., Springfield, Vt.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.

GEAR SHAVERS
Fellows Gear Shaper Co., Springfield, Vt.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.

GEARS, AND GEAR BLANKS, Non-metallic
Boston Gear Works, 14 Hayward St., Quincy 71, Mass.

Cincinnati Gear Co., Wooster Pike and Mariemont Ave., Cincinnati, Ohio
Diefendorf Gear Corp., Box 934, Syracuse, N. Y.
Gear Specialties, Inc., 2635 W. Medill Ave., Chicago 47, Ill.
Greaves Machine Tool Co., 2011 Eastern Ave., Cincinnati, Ohio
Illinois Gear & Mch. Co., 2108 No. Natchez Ave., Chicago 35, Ill.
New Jersey Gear & Mfg. Co., Hillside, N. J.
Philadelphia Gear Works, Erie Ave. and G. St., Philadelphia, Pa.
Ryerson, Jos. T. & Son, Inc., 16th and Rockwell St., Chicago 8, Ill.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio

GEARS, Cut
Automotive Gear Works, Inc., South 8th & O St., Richmond, Ind.
Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia Pa.
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Boston Gear Works, 14 Hayward St., Quincy 71, Mass.
Cincinnati Gear Co., Wooster Pike and Mareimont Ave., Cincinnati, Ohio
Diefendorf Gear Corp., Box 934, Syracuse, N. Y.
Fairfield Mfg. Co., 2309 S. Earl Ave., Lafayette, Ind.
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Gear Specialties, Inc., 2635 W. Medill Ave., Chicago 47, Ill.
Greaves Machine Tool Co., 2011 Eastern Ave., Cincinnati, Ohio
Horsburgh & Scott Co., 5114 Hamilton, Cleveland, Ohio
Illinois Gear & Mch. Co., 2100 No. Natchez Ave., Chicago 35, Ill.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
New Jersey Gear Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Philadelphia Gear Works, Erie Ave. and G St., Philadelphia, Pa.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

GENERATORS, Electric
General Electric Co., Schenectady, N. Y.
Reliance Electric & Engrg. Co., 1200 Ivanhoe Rd., Cleveland 10, Ohio

GRADUATING MACHINES
Gorton, Geo., Mch. Co., 1321 Racine St., Racine, Wis.

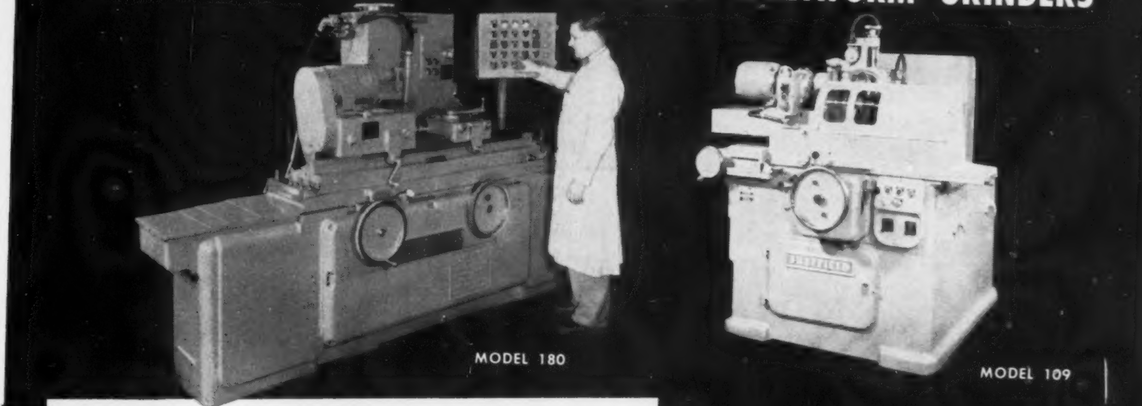
GREASES—See Lubricating Oils and Greases

GRINDERS, Bench, Floor and Snag
Delta Power Tool Div., 400 Lexington Ave., Pittsburgh, Pa.
Jones & Lamson Mch. Co., Springfield, Vt.
Mummert-Dixon Co., Hanover, Pa.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio
South Bend Lathe Works, South Bend 22, Ind.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio
Thor Power Tool Co., 175 N. State St., Aurora, Ill.
U. S. Burke Machine Tool Div., Brotherton Rd., Cincinnati 27, Ohio

GRINDERS, Carbide Tool
Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh, Pa.
Elox Corp. of Mich., Royal Oak 3, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.

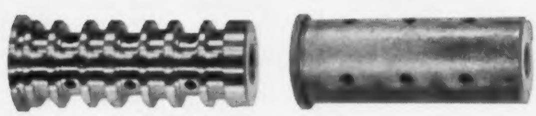
(Continued on page 306)

Grind PRECISION FORMS, GROOVES and LANDS in Record Time with SHEFFIELD'S CRUSHTRUE MULTIFORM GRINDERS



MODEL 180

MODEL 109



Servo Mechanism Sleeve

The seven grooves of this servo mechanism sleeve are crushtrue ground from the solid to a tolerance of .001" on spacing and .002" on minor diameter in 55 seconds. Material, SAE 52-100; Rockwell, 58-60 C; depth of plunge grind, .145".

Forms and grooves are precision ground on these machines with comparable speed and economy.

For complete details write to Department 9, The Sheffield Corporation, Dayton 1, Ohio, U.S.A.

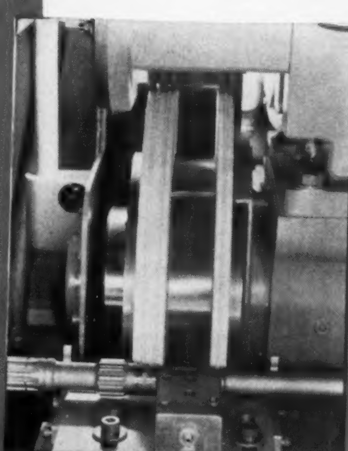
Bearing Race

Aircraft Servo Component

Hydraulic Servo Units

Self-aligning Bearings

Crushtrue Roll



Grinding Grooves in a Transmission Shaft

MASTER CRAFTSMAN SHEFFIELD HEADQUARTERS

SHEFFIELD

MANUFACTURE AND MEASUREMENT FOR MANKIND

7214

For more information fill in page number on Inquiry Card, on page 225

Metallurgical Products Dept. of General Electric Co., Box 237 Roosevelt Park Annex, Detroit 32, Mich.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.

GRINDERS, Die and Mold

Norton Co., 1 New Bond St., Worcester 6, Mass.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

GRINDERS, Drill Point

Atlas Press Co., 20108 N. Pitcher, Kalamazoo, Mich.
Consolidated Mch. Tool Div., 565 Blossom Rd., Rochester 10, N. Y.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Standard Electrical Tool Co., 2500 River Rd., Cincinnati 4, Ohio

GRINDERS, Face Mill

Kearny & Trecker Corp., Milwaukee 14, Wis.
Mattison Machine Works, 545 Blackhawk Park Ave., Rockford, Ill.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

GRINDERS, Knife and Shear

Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Mattison Machine Works, Rockford, Ill.
Mummert-Dixon Co., Hanover, Pa.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

GRINDERS, Portable Electric

Chicago Pneumatic Tool Co., New York 17, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Standard Electrical Tool Co., 2500 River Rd., Cincinnati 4, Ohio
Thor Power Tool Co., 175 N. State St., Aurora, Ill.

GRINDERS, Portable Pneumatic

Chicago Pneumatic Tool Co., New York 17, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Madison-Kipp Corp., Madison, Wis.
Thor Power Tool Co., Aurora, Ill.

GRINDERS, Tap

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.

GRINDERS, Tool and Cutter

Atlas Press Co., 20108 N. Pitcher, Kalamazoo, Mich.
Barber-Colman Co., Rock and Montague, Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling and Grinding Mchs., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., 400 Lexington Ave., Pittsburgh, Pa.
Elox Corp. of Mich., Royal Oak 3, Mich.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gallmeyer & Livingston Co., 336 Straight Ave., S. W., Grand Rapids 4, Mich.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Gorton, Geo., Mch. Co., 1321 Racine St., Racine, Wis.
Homestrand, Inc., Larchmont, N. Y.
Landis Tool Co., Waynesboro, Pa.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Mummert-Dixon Co., Hanover, Pa.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio
Norton Co., 1 New Bond St., Worcester 6, Mass.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
South Bend Lathe Wks., South Bend 22, Ind.
Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio

GRINDERS, Toolpost

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

GRINDING GAGES—See Gages, Grinding

GRINDING MACHINES, Abrasive Belt

Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Mattison Mch. Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

(Continued on page 308)

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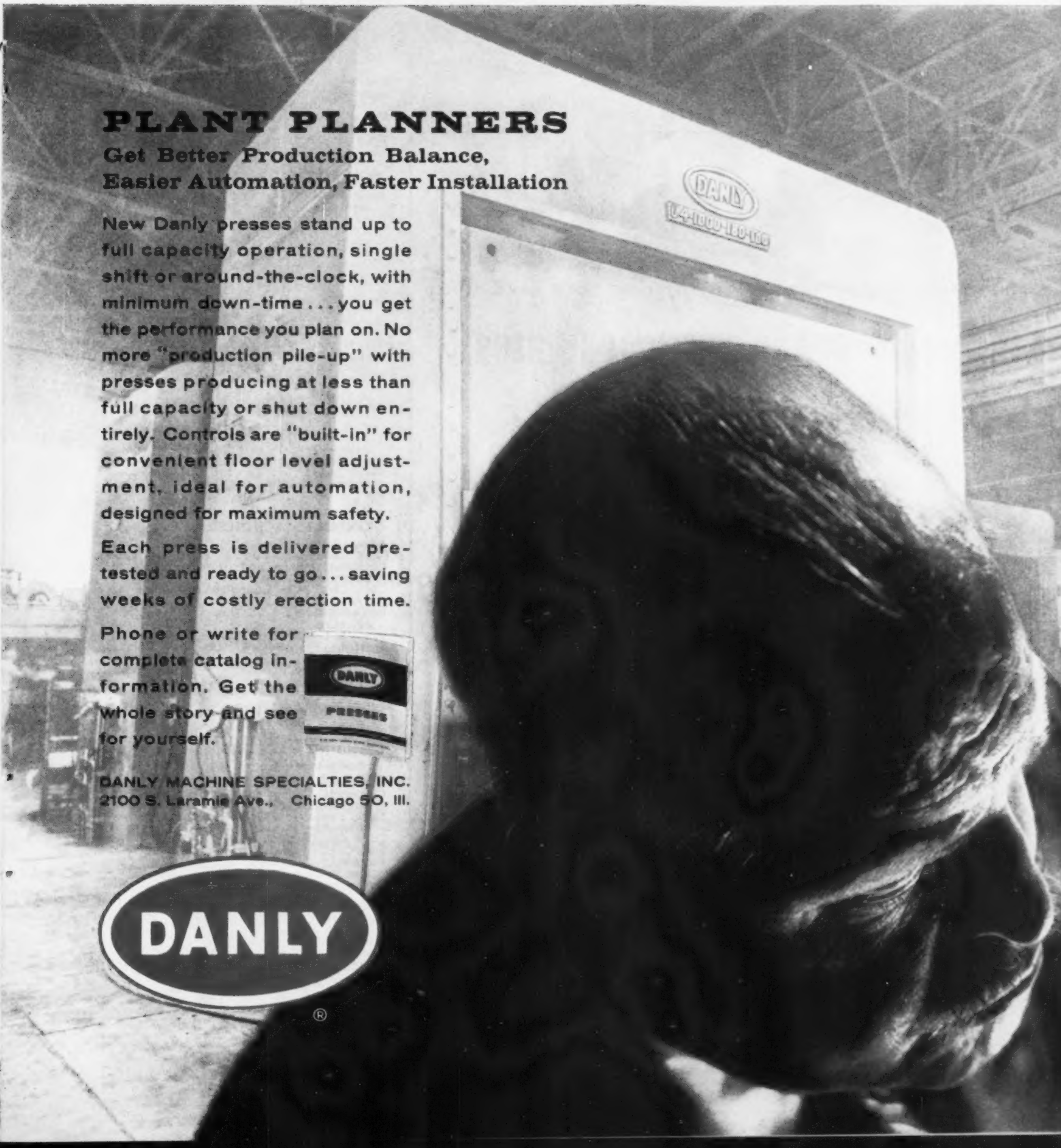
DANLY

PRESSES



Thor Power Tool Co., 175 N. State St., Aurora, Ill.
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

GRINDING MACHINES, Broach

Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Gallmeyer & Livingston Co., 336 Straight, S. W., Grand Rapids 2, Mich.
Lapointe Mch. Tool Co., 34 Tower St., Hudson, Mass.
National Broach & Mch. Co., 5600 St. Jean Detroit 13, Mich.
Thompson Grinder, 1534 W. Main, Springfield, Ohio

GRINDING MACHINES, Cam

Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Van Norman Mch. Co., 3640 Main St., Springfield 7, Mass.

GRINDING MACHINES, Centerless

Bryant Chucking Grinder Co., Clinton St., Springfield, Vt.
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Landis Tool Co., Waynesboro, Pa.
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.
Van Norman Co., Springfield, Mass.

GRINDING MACHINES, Crankshaft

Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Van Norman Mch. Co., Springfield, Mass.

GRINDING MACHINES, Cylindrical

Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Frauenthal Div., Muskegon, Mich.
Gallmeyer & Livingston Co., 336 Straight, S. W., Grand Rapids 2, Mich.
Landis Tool Co., Inc., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Sheffield Corp., Box 893, Dayton 1, Ohio
Standard Electrical Tool Co., 2500 River Rd., Cincinnati 4, Ohio
Van Norman Co., 2640 Main St., Springfield 7, Mass.

GRINDING MACHINES, Disc

Besley-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Brown & Sharpe Mfg. Co., Providence, R. I.
Delta Power Tools Div., 400 Lexington Ave., Pittsburgh 8, Pa.
Gardner Machine Co., Beloit, Wis.
Mattison Machine Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

GRINDING MACHINES, Gear

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gear Grinding Mch. Co., 3901 Christopher St., Detroit 11, Mich.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Lees-Bradner Co., Cleveland, Ohio
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Sheffield Corp., Box 893, Dayton 1, Ohio

GRINDING MACHINES, Internal

Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.
Bryant Chucking Grinder Co., Clinton St., Springfield, Vt.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Frauenthal Div., Muskegon, Mich.
Gallmeyer & Livingston Co., 336 Straight, S W., Grand Rapids 2, Mich.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio
Van Norman Mch. Co., Springfield, Mass.
Wicaco Machine Corp., Wayne Junction, Philadelphia, Pa.

GRINDING MACHINES, Jig

Fosdick Mch. Tool Co., 1638 Blue Rock St., Cincinnati 23, Ohio
Gallmeyer & Livingston Co., 336 Straight, S W., Grand Rapids 2, Mich.
Moore Special Tool Co., Inc., 740 Union Ave., Bridgeport, Conn.

GRINDING MACHINES, Profile

Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Jones & Lamson Mch. Co., Springfield, Vt.
Sheffield Corp., Box 893, Dayton 1, Ohio

GRINDING MACHINES, Roll

Landis Tool Co., Waynesboro, Pa.

GRINDING MACHINES, Surface Reciprocating

Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Delta Power Tool Div., 400 Lexington Ave., Pittsburgh, Pa.
DoAll Co., Des Plaines, Ill.
Elox Corp. of Mich., Royal Oak 3, Mich.
Foote-Burt Co., 13000 St. Clair Ave., Cleveland 8, Ohio
Gallmeyer & Livingston Co., 336 Straight Ave., S. W., Grand Rapids 4, Mich.
Gardner Machine Co., Beloit, Wis.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Homestrand, Inc., Larchmont, N. Y.
Mattison Machine Works, Rockford, Ill.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Reid Bros. Co., Inc., Beverly, Mass.
Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio
Van Norman Mch. Co., Springfield, Mass.

(Continued on page 310)

For more information fill in page number on Inquiry Card, on page 225

GRINDING MACHINES, Surface Rotary
Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass. (Rotary)
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Blanchard Machine Co., 64 State St., Cambridge, Mass.
Gardner Machine Co., Beloit, Wis.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Mattison Machine Works, Rockford, Ill.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio
Norton Co., 1 New Bond St., Worcester 6, Mass.
Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio
Van Norman Mch. Co., Springfield, Mass.
Walker, O. S., Co., Inc., Worcester, Mass.

GRINDING MACHINES, Thread
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Jones & Lamson Mch. Co., Springfield, Vt.
Landis Machine Co. (Centerless), Waynesboro, Pa.
Sheffield Corp., Box 893, Dayton 1, Ohio

GRINDING MACHINES, Universal
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Frauenthal Div., Muskegon, Mich.
Gallmeyer & Livingston Co., 336 Straight, S. W., Grand Rapids 2, Mich.
Gorton Mch. Co., Geo., 1321 Racine St., Racine, Wis.
Jones & Lamson Mch. Co., Springfield, Vt.
Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Springfield Mch. Tool Co., 613 W. Southern Ave., Springfield, Ohio

GRINDING WHEEL DRESSING AND FORMING DEVICES
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoALL Co., Des Plaines, Ill.
Jones & Lamson Mch. Co., Springfield, Vt.
Metal Carbides Corp., Youngstown, Ohio
Moore Special Tool Co., Inc., 740 Union Ave., Bridgeport 7, Conn.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Sheffield Corp., Box 893, Dayton 1, Ohio

GRINDING WHEELS
Besly-Welles Corp. (Abrasive Div.), 20 N. Wacker Drive, Chicago 6, Ill.
Blanchard Machine Co., 64 State St., Cambridge, Mass.
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Cincinnati Milling Products Div., Cincinnati 9, Ohio
Cratex Manufacturing Co., 81 Natoma St., San Francisco, Calif.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
DoALL Co., 254 N. Laurel Ave., Des Plaines, Ill.
Gardner Machine Co., Beloit, Wis.
Metal Carbides Corp., Youngstown, Ohio
Norton Co., 1 New Bond St., Worcester 6, Mass.
Simonds Abrasive Co., Tacony and Fraley St., Bridgesburg, Philadelphia, Pa.
Sterling Grinding Wheel Co., Tiffin, Ohio

GROOVING TOOLS, Internal
Scully-Jones & Co., 1906 So. Rockwell St., Chicago 8, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.

HAMMERS, Drop—See Forging Hammers

HAMMERS, Portable Electric
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Thor Power Tool Co., Aurora, Ill.

HAMMERS, Portable Pneumatic
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Thor Power Tool Co., 175 N. State St., Aurora, Ill.

HAMMERS, Power
Chambersburg Engrg. Co., Chambersburg, Pa.
Edlund Mchry. Co. Div., Cortland, N. Y.
Erie Foundry Co., Erie, Pa.
Yoder Co., 5504 Walworth Ave., Cleveland 2, Ohio.

HARDENING FURNACES
General Electric Co., Schenectady, N. Y.

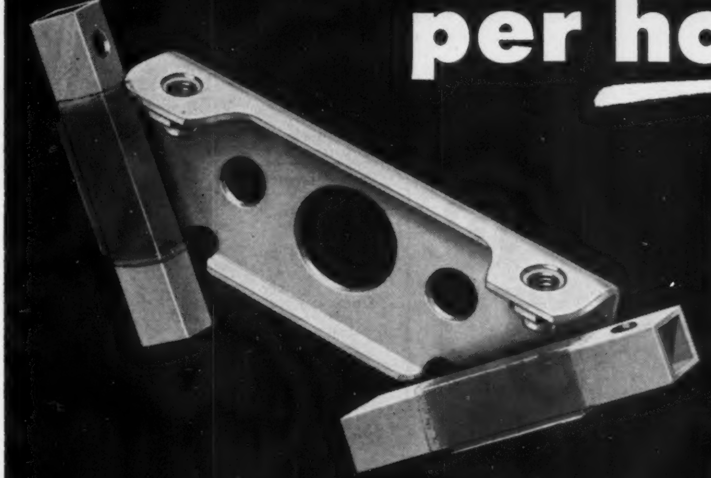
HARDNESS TESTERS
Shore Instrument & Mfg. Co., 90-35C Van Wyck Exp., Jamaica 35, N. Y.
Wilson Mechanical Instrument Co., Inc., 230-D Park Ave., New York, N. Y.

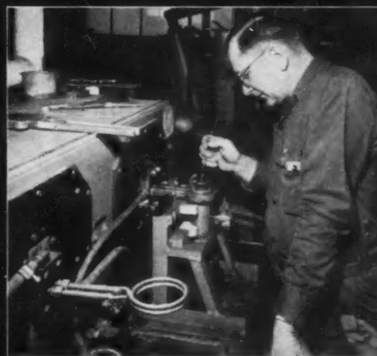
HEAT-TREATING EQUIPMENT—See Annealing Furnaces, Flame Hardening Machines, Induction-heating Equipment

HOBS
Barber-Colman Co., Rock and Montague, Rockford, Ill.
Goddard & Goddard Co., Detroit, Mich.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Twist Drill & Tool Co., Rochester, Mich.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Star Cutter Co., 34500 Grand River, Farmington, Mich.

(Continued on page 312)

JACK & HEINTZ Saves $15.84 per hour...





Jack & Heintz Inc. silver brazes over 25 different parts on this 15 KW, 10,000 cycle TOCCO machine.

with TOCCO* Induction Brazing

Brazing Costs Down

When Jack & Heintz engineers switched from torch brazing to automatic induction, brazing cost of these inverter brush mounts fell from $.05 to $.006 each—a reduction of 83% in direct labor costs alone! Additional savings result because less cleaning is required after TOCCO, and fuel costs are much lower, too.

Brazing Production Up

While costs dropped, production on the part zoomed—from 40 to 360 brazed assemblies per hour. Furthermore, rejects and scrap, formerly high, are now negligible.

Versatility

The part shown is just one of over 25 parts, large and small, which alert J & H engineers have converted from old-fashioned brazing methods to modern, automatic TOCCO. Overall brazing costs (TOCCO brazing versus former methods used) are down 75%—brazing speed, up 100%.

* * *

If the manufacture of *your* product involves brazing, heat-treating, forging or melting of ferrous or non-ferrous metals, don't overlook TOCCO as a sound method of increasing production, improving product quality and slashing costs.

THE OHIO CRANKSHAFT COMPANY

TOCCO

*Trade Mark Reg. U. S. Pat. Off.

Mail Coupon Today

NEW FREE BULLETIN

THE OHIO CRANKSHAFT CO.
Dept. M-12, Cleveland 5, Ohio

Please send copy of "Typical Results of TOCCO Induction Brazing and Soldering".

Name__________

Position__________

Company__________

Address__________

City_____ Zone_____ State_____

For more information fill in page number on Inquiry Card, on page 225

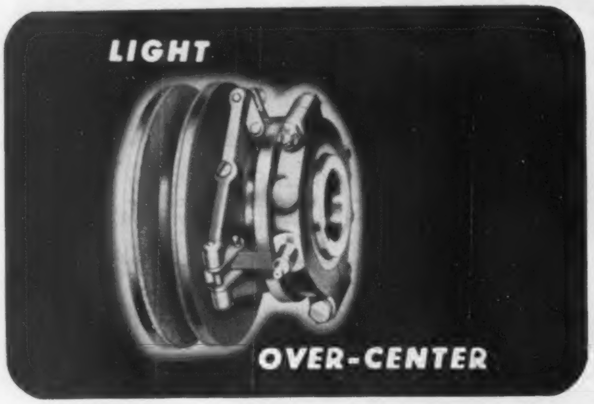
HOISTS, Air
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Thor Power Tool Co., Aurora, Illinois

HOISTS, Electric
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.

HONING MACHINES
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Fulmer, C. Allen Co., 1231 First National Bank Bldg., Cincinnati 2, Ohio
Jes-Cal Co., Fraser, Mich.
Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.
Moline Tool Co., 102 - 20th St., Moline, Ill.
Sunnen Products Co., 7900 Manchester Ave., St. Louis 17, Mo.
Van Norman Mch. Co., 3640 Main St., Springfield 7, Mass.

HONING STONES
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Jes-Cal Co., Fraser, Mich.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Sunnen Products Co., 7900 Manchester Ave., St. Louis 17, Mo.

HOSE
American Metal Hose Br. American Brass Co., 25 Broadway, New York, N. Y.
Schrader's Son, A., 470 Vanderbilt Ave., Brooklyn 38, N. Y.



HYDRAULIC MACHINERY
Tools and equipment
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Bethlehem Steel Corp., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Colonial Broach & Machine Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio.
Erie Foundry Co., Erie, Pa.
Farquhar, A. B., Div. Oliver Corp., York, Pa.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Michigan Drill Head Co., Detroit 34, Mich.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Motch & Merryweather Machinery Co., Penton Bldg., Cleveland, Ohio
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.
Vickers Incorporated, Div. of Sperry Rand Corp., 1402 Oakman Blvd., Detroit, Mich.
Wilson, K. R., Inc., 211 Mill St., Arcade N. Y.

HYDRAULIC POWER UNITS OR TOOL HEADS
Barnes Drill Co., 814 Chestnut, Rockford 3, Ill.
Barnes, W. F. & John Co., 201 S. Waterford St., Rockford, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford 12, Conn.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio.
Michigan Drill Head Co., Detroit 34, Mich.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Vickers Incorporated, Div. of Sperry Rand Corporation, 1402 Oakman Blvd., Detroit, Mich.

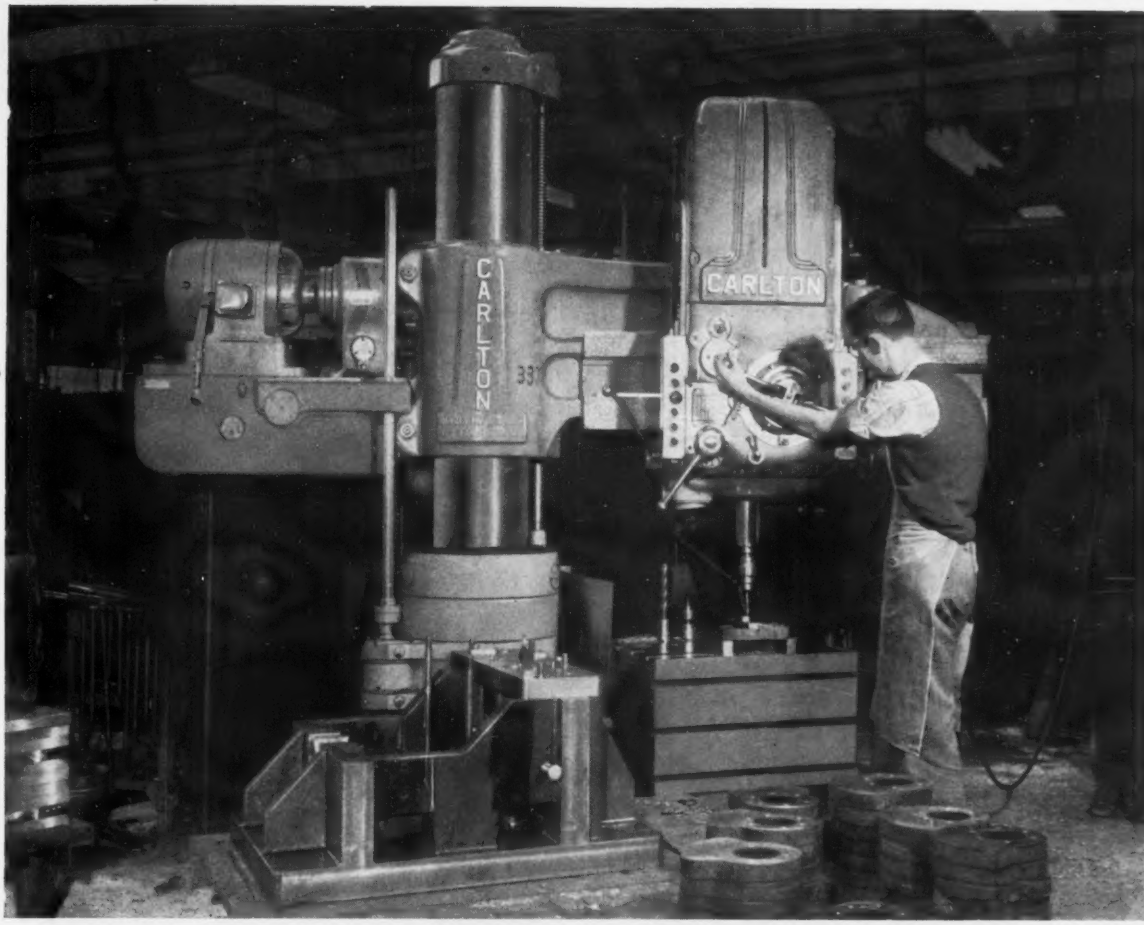
INDEXING and SPACING EQUIPMENT
Austin Industrial Corp., White Plains, N. Y.
Brown & Sharpe Mfg. Co., Providence, R. I.
Eisler Engrg. Co. Inc., 750 South 13th St., Newark, N. J.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Michigan Drill Head Co., Detroit 34, Mich.
Micro-Positioner Corp., 716 Wilshire Blvd., Santa Monica, Calif.
Nichols-Morris Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Opto-Metric Tools, Inc., 137 Varick St., New York, N. Y.
Sundstrand Mch. Tool Co., 2531 - 11th St., Rockford, Ill.
Van Norman Mch. Co., 3640 Main St., Springfield 7, Mass.
Wadell Equip. Co., Clark, N. J.
Western Machine Tool Works, Holland, Mich.

INDICATOR BASES, Magnetic
Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
DoALL Co., Des Plaines, Ill.
duMont Corp., 289 Wells St., Greenfield, Mass.
Starrett, L. S. Co., Athol, Mass.

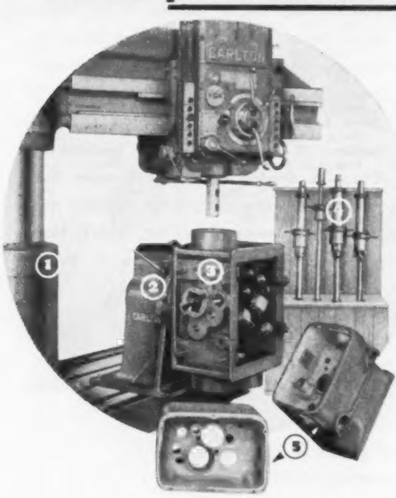
INDICATOR LIGHTS—See Lights, Indicator

INDICATORS, Dial
Ames, B. C., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoALL Co., 254 N. Laurel Ave., Des Plaines, Ill.

(Continued on page 314)



Carlton production drilling for production line assembly



Running time reduced from 7 hours on previous method to 5.25 on this Carlton engineered set-up:
(1) Carlton 3-A radial drill
(2) master trunnion
(3) revolving jig
(4) boring bars
(5) transmission body casting
25% savings effected by eliminating horizontal operation.

Carlton radial drills, properly tooled, give you production hole drilling with the precision performance so necessary for production line assembly. Parts come out of the drill jig with the uniformity that permits interchangeability of parts, eliminates unnecessary operations, makes substantial savings.

Carlton engineers will be glad to work with your engineers in recommending the best Carlton and the most efficient tooling for your requirements. Carlton radial drills are made in 5 models with arm lengths from 3-ft to 12-ft and column diameters from 9″ to 26″. Carlton horizontal drills made in 4H and 5H sizes. For complete information, call your machine tool distributor, see the Carlton brochure in Sweets Machine Tool Catalog, or write The Carlton Machine Tool Co., Cincinnati 25, Ohio, U.S.A.

Carlton

HORIZONTAL AND RADIAL DRILLS

For more information fill in page number on Inquiry Card, on page 225

Federal Products Corp., P. O. Box 1027, Providence, R. I.
National Automatic Tool Co., S. 7th - N. Sts., Richmond, Ind.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S. Co., Athol, Mass.

INDICATORS, Speed

Brown & Sharpe Mfg. Co., Providence, R. I.
General Electric Co., Schenectady, N. Y.
Reliance Elec. & Engrg. Co., 1200 Ivanhoe Rd., Cleveland 10, Ohio
Starrett, The L. S., Co., Athol, Mass.

INDICATORS, Test

Brown & Sharpe Mfg. Co., Providence, R. I.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
National Automatic Tool Co., S. 7th - N Sts., Richmond, Ind.
Starrett, The L. S., Co., Athol, Mass.

INDUCTION HEATING EQUIPMENT

Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
General Electric Co., Schenectady, N. Y.
Ohio Crankshaft Co., 3800 Harvard Ave., Cleveland, Ohio

INTENSIFIERS, Hydraulic

Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Logansport Mch. Co., Inc., Logansport, Ind.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.

JACKS, Planer—See Set-up Equipment

JIG BORERS

American Sip Corp., 100 E. 42nd St., New York 17, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio
Homestrand, Inc., Larchmont, N. Y.
Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

JIGS AND FIXTURES

Acromark Co., 9-11 Morrell St., Elizabeth, N. J.
Bath, Cyril Co., Aurora & Solon Road, Solon, Ohio
Columbus Die, Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio
Hartford Special Mchry. Co., 287 Homestead Ave., Hartford, Conn.
Metal Carbides Corp., Youngstown 12, Ohio
Modern Industrial Engrg. Co., 14230 Birwood Ave., Detroit 28, Mich.
Portage Mch. Co., 1025 Sweitzer Ave., Akron 11, Ohio
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio

KEYSEATERS

Baker Bros., Inc., Station F, P. O. Box 101, Toledo 10, Ohio
Bliss, E. W. Co., Canton, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Davis Keyseater Co., 405 Exchange St., Rochester 8, N. Y.
Heller Tool Co., Heller Dr., Newcomerstown, Ohio
Mitts & Merrill, 1809 S. Water St., Saginaw, Mich.

LAPPING MACHINES

Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill. (Lapmaster Div.)
DoAll Co., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32 Mich.
Gleason Works, 1000 University Ave., Rochester, N. Y.
Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Size Control Co., Div. of American Gage & Mch. Co., 2500 W. Washington Blvd., Chicago 12, Ill.

LATHE ATTACHMENTS

Atlas Press Co., Kalamazoo, Mich.
Axelson Mfg. Co., P. O. Box 15335, Vernon Sta., Los Angeles 58, Calif.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Jones & Lamson Mch., 512 Clinton St., Springfield, Vt.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Sheldon Mch. Co., Inc., 4258 N. Knox Ave., Chicago 41, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

LATHES, AUTOMATIC—See Chucking Machines

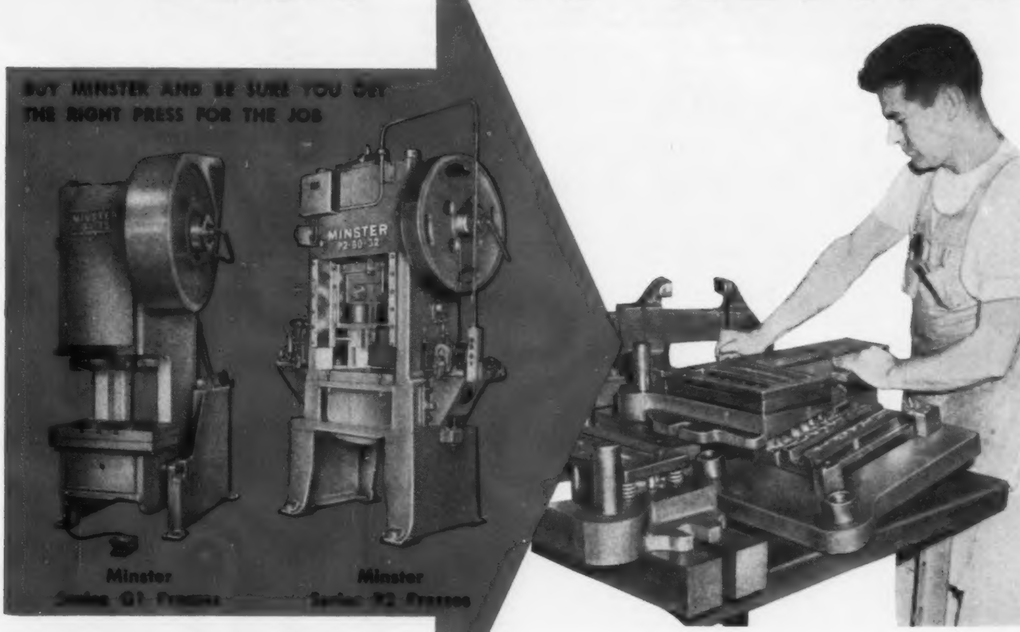
LATHES, Axle

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Consolidated Mch. Tool Div., Farrel-Birmingham Co., Inc., Rochester 10, N. Y.
Monarch Mch. Tool Co., Oak St., Sidney, Ohio
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sundstrand Mch. Tool Co., 2531 - 11th St., Rockford, Ill.

(Continued on page 316)

A Minster Press means

LESS DIE REPAIR



These Minster Press features *protect* dies from needless expensive repairs.

1 Rugged Minster Frames assure the greatest rigidity with the least possible deflection.

2 Accurate alignment of slide face and bed is assured by Minster Design. Beds scraped to surface plate. Long slide ways scraped square to slide face. Gibs accurately ground and adjusted for proper clearance using ground spacers on all front gibs of presses over 60 tons.

3 Minster bearing bushings honed to proper clearance thus reducing impact shock and snap-thru backlash.

4 Minster patented Combination Air Friction Clutch and Brake has smooth shock absorbing action which tends to reduce die wear caused by impact. Fast controlled engagement or disengagement on 360° surfaces gives opportunity for operator to stop slower presses before dies close in case of misfeed. It also makes possible the use of precision switches in dies to anticipate misfeeds on automatic operations and stop press before serious damage occurs.

Build a sound replacement program modernize with Minster Presses

THE MINSTER MACHINE COMPANY

MINSTER, OHIO

MINSTER®
PRESSES

For more information fill in page number on Inquiry Card, on page 225

LATHES, Bench

Atlas Press Co., Kalamazoo, Mich.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Homestrand, Inc., Larchmont, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Levin, Louis & Son, Los Angeles 21, Calif.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

LATHES, Boring

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Bullard Co., Brewster St., Bridgeport 2, Conn
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25 Ohio.
Sidney Machine Tool Co., Sidney, Ohio.
Wickes Brothers, 512 No. Water St., Saginaw, Mich.

LATHES, Car Wheel

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Bullard Co., Bridgeport 6, Conn.
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.

LATHES, Crankshaft

Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Wickes Brothers, 512 No. Water St., Saginaw, Mich.

LATHES, Double-End

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Wickes Brothers, 512 No. Water St., Saginaw, Mich.

LATHES, Duplicating

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Hydra-Feed Machine Tool Corp., 730 W. Eight Mile Rd., Ferndale 20, Mich.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio.
Sidney Machine Tool Co., Sidney, Ohio.
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.

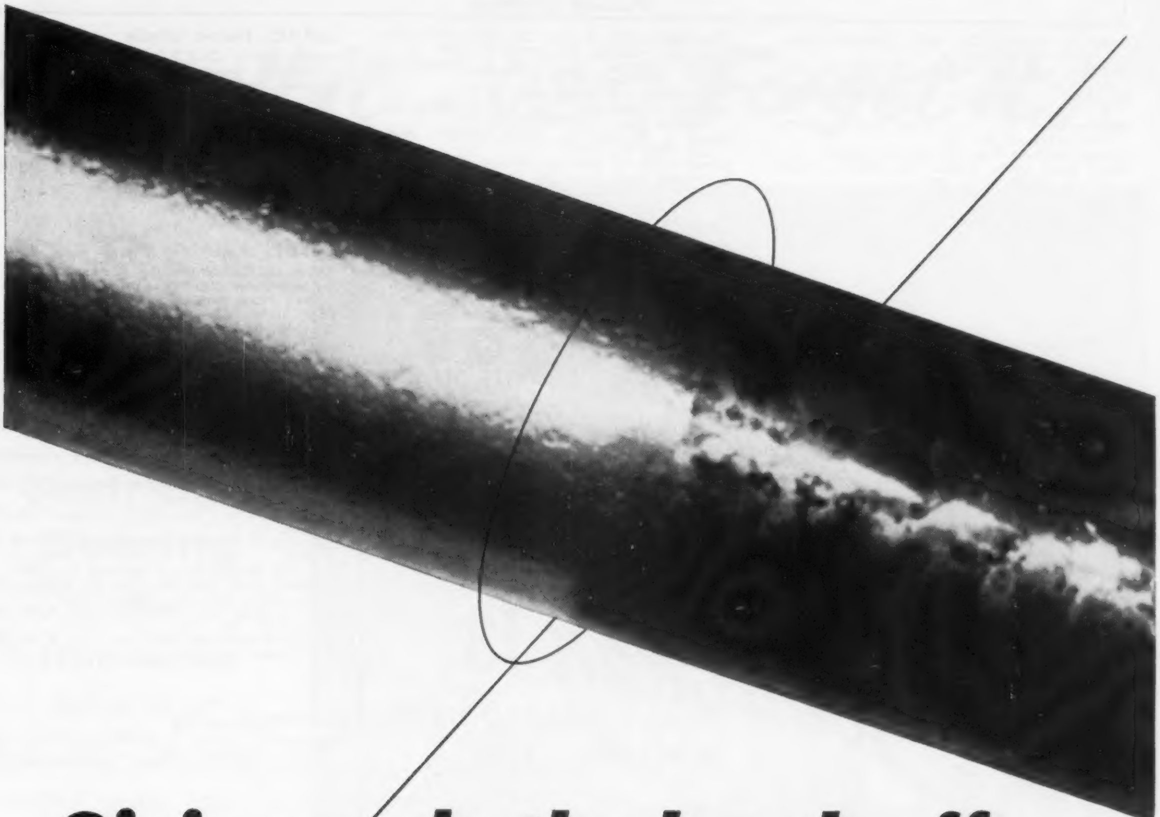
LATHES, Engine, Manufacturing

American Tool Works Co., Pearl and Eggleston Aves., Cincinnati, Ohio
Atlas Press Co., Kalamazoo, Mich.
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Calif.
Barber-Colman Co. (Hendey Mch. Div.), Rockford, Ill.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Oakley, Cincinnati 9, Ohio
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Homestrand, Inc., Larchmont, N. Y.
Hydra-Feed Mch. Tool Corp., 730 W. 8 Mile Rd., Ferndale 20, Mich.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
Sidney Machine Tool Co., Sidney, Ohio
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Springfield Mch. Tool Co., Springfield, Ohio
Western Machine Tool Works, Holland, Mich.
Wickes Brothers, 512 No. Water St., Saginaw, Mich.

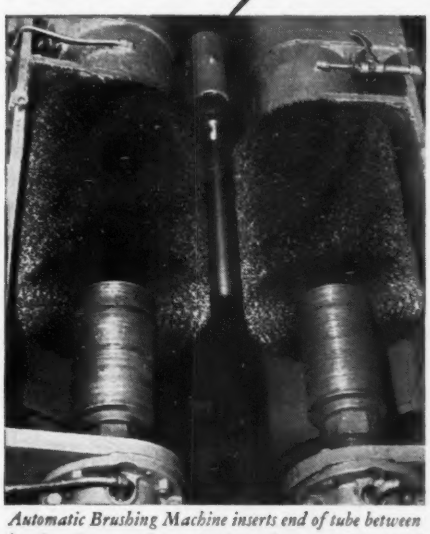
LATHES, Engine, Toolroom

American Tool Works Co., Pearl and Eggleston Aves., Cincinnati, Ohio
Atlas Press Co., Kalamazoo, Mich.
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Calif.
Barber-Colman Co. (Hendey Mch. Div.), Rockford, Ill.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Oakley, Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Homestrand, Inc., Larchmont, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio

(Continued on page 318)



Giving scale the brush off



Automatic Brushing Machine inserts end of tube between brush rolls . . . cleans rotating tube on predetermined cycle . . . stops and ejects tube.

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BRUSHING MACHINES • FOUNDRY MOLDING MACHINES

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Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
Sidney Machine Tool Co., Sidney, Ohio
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Springfield Mch. Tool Co., Springfield, Ohio
Western Machine Tool Works, Holland, Mich.
Wickes Brothers, 512 No. Water St., Saginaw, Mich.

LATHES, Gap

Atlas Press Co., Kalamazoo, Mich.
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Calif.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Oakley, Cincinnati 9, Ohio
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Homestrand, Inc., Larchmont, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Sidney Machine Tool Co., Sidney, Ohio
Springfield Mch. Tool Co., Springfield, Ohio

LATHES, Gun

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Springfield Machine Tool Co., Springfield, Ohio
Wickes Brothers, 512 No. Water St., Saginaw, Mich.

LATHES, Hollow Spindle

Axelson Mfg. Co., P.O. Box 15335, Vernon Sta., Los Angeles 58, Calif.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

LATHES, Roll

American Tool Works Co., Cincinnati 2, Ohio
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Bliss, E. W., Co., Canton, Ohio
LeBlond, R. K., Mch. Tool Co., Cincinnati 18, Ohio
Monarch Mch. Tool Co., Oak St., Sidney, Ohio

LATHES, Speed, Second-operation

Atlas Press Co., Kalamazoo, Mich.
Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
Gisholt Mch. Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
LeBlond, R. K., Mch. Tool Co., Cincinnati 18, Ohio
Lodge & Shipley Co., Cincinnati 25, Ohio
Monarch Mch. Tool Co., Oak St., Sidney, Ohio
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sheldon Mch. Co., 4258 N. Knox Ave., Chicago 41, Ill.
Standard Electrical Tool Co., 2500 River Rd., Cincinnati 4, Ohio

LATHES, Spinning

Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 19, Ohio
Lodge & Shipley Co., The, Cincinnati 25, Ohio

LATHES, Toolroom—See Lathes, Engine, Toolroom

LATHES, Turret, Automatic

Atlas Press Co., Kalamazoo, Mich.
Brown & Sharpe Mfg. Co., Providence, R. I
Bullard Co., Brewster St., Bridgewater 2, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Jones & Lamson Mch. Co., 512 Clinton St., Springfield, Vt.
Nat'l Acme Co., 170 E. 131st St., Cleveland 3, Ohio
New Britain Mch. Co., New Britain-Gridley Div., New Britain, Conn.

LATHES, Turret, Ram Type, Saddle Type

Atlas Press Co., Kalamazoo, Mich.
Bardons & Oliver Inc., Ft. W. 9th St., Cleveland 13, Ohio
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Brothers, Inc., 1420 College Ave., Elmira, N. Y.
Jones & Lamson Mch. Co., 512 Clinton St., Springfield, Vt.
Levin & Son, Inc., Louis, Los Angeles 8, Calif.
New Britain Mch. Co., New Britain-Gridley Div., New Britain, Conn.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sheldon Mch Co., Inc., 4258 N. Knox Ave., Chicago 41, Ill.
South Bend Lathe Wks., South Bend 22, Ind.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio

LATHES, Turret Vertical—See Boring Mills, Vertical

(*Continued on page 320*)

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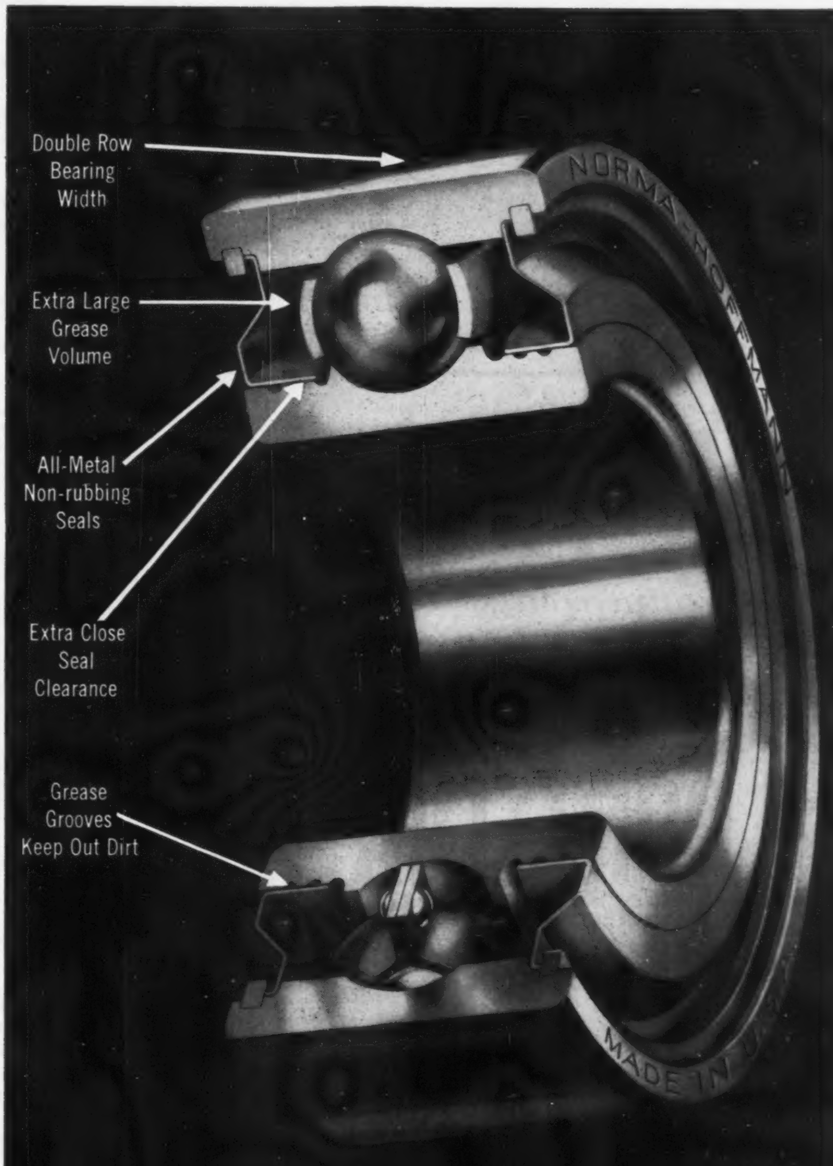

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FIELD OFFICES: Atlanta, Chicago, Cincinnati, Cleveland, Dallas, Denver, Detroit, Kansas City, Los Angeles, Philadelphia, San Francisco, Seattle

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LAYOUT and DRAFTING TOOLS
Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
Starrett, L. S., Co., Athol, Mass.

LEVELS
South Bend Lathe Wks., South Bend 22, Ind.
Starrett, The L. S., Co., Athol, Mass.

LIGHTING FIXTURES, Machine
Sun-Lite Mfg. Co., 2555 Bellevue Ave., Detroit 7, Mich.

LIGHTS, Indicator
Dialight Corporation, 60 Stewart Ave., Brooklyn 37, N. Y.
General Electric Co., Schenectady, N. Y.

LIMIT SWITCHES—See Switches, Limit

LUBRICATING OILS and GREASES
Cities Service Oil Co., 70 Pine St., New York, N. Y.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Lubriplate Div., Fiske Bros. Refining Co., 120 Lockwood St., Newark 5, N. J.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.

LUBRICATING SYSTEMS
Farval Corp., 3249 E. 80th St., Cleveland, Ohio
Gits Bros. Mfg. Co., 1846 S. Kilbourn Ave., Chicago 23, Ill.
Madison-Kipp Corp., Madison, Wis.

MACHINERY, Used and Rebuilt
Eastern Mchry. Co., 1000 Tennessee Ave., Cincinnati, Ohio
Michigan Drill Head Co., Van Dyke, Mich.
Miles Mchry Co., 2025 E. Genessee Ave., Saginaw, Mich.
Motch & Merryweather Mchry. Co., 888 E. 70th St., Cleveland 3, Ohio
Van Keuren Co., Watertown, Mass.
Williams, J. H., & Co., 400 Vulcan St., Buffalo 7, N. Y.

MACHINISTS' SMALL TOOLS
Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
Niagara Mch. & Tool Wks., 637-697 Northland Ave., Buffalo 11, N. Y.
Starrett, L. S., Co., Athol, Mass.

MANDRELS—See Arbors and Mandrels

MARKING MACHINES and DEVICES
Acromark Co., 9-11 Morrell St., Elizabeth 4, N. J.
Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Gorton Mch. Co., 1321 Racine St., Racine, Wis.

MATERIAL-HANDLING TRUCKS—See Trucks, Material Handling

MEASURING MACHINES
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Van Keuren Co., Watertown 72, Mass.

MEASURING WIRES, Thread, Spline, Gear
Sheffield Corp., Dayton 1, Ohio
Throudwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
Van Keuren Co., Watertown 72, Mass.

MICROMETER HEADS
Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
DoALL Co., Des Plaines, Ill.
Starrett, The L. S., Co., Athol, Mass.

MICROMETERS, Outside, Inside, Depth
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Van Keuren Co., Watertown 72, Mass.

MICROSCOPES, Toolmakers'
DoAll Co., Des Plaines, Ill.
Opto-Metric Tools, Inc., 137 Varick St., New York, N. Y.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

MILLING MACHINE ATTACHMENTS
Bridgeport Mches., Inc., 500 Lindley St., Bridgeport 6, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
G & L and Hypro Div., Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Greaves Mch. Tool Div., 2011 Eastern Ave., Cincinnati 2, Ohio
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Homestrand, Inc., Larchmont, N. Y.
Kearney & Trecker Corp., Milwaukee, Wis.
Sheldon Mch. Co., Inc., 4258 N. Knox Ave., Chicago 41, Ill.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Automatic
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Machine Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Springfield, Vt.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Jones & Lamson Mch. Co., 160 Clinton St.
Kearney & Trecker Corp., Milwaukee, Wis.
Marac Machinery Corp., Yonkers, N. Y.

Millholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Motch & Merryweather Machinery Co., Penton Bldg., Cleveland, Ohio
Pratt & Whitney Co., Inc., West Hartford, Conn.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

MILLING MACHINES, Bench, Hand

Atlas Press Co., Kalamazoo, Mich.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Nichols-Morris Corp., 76 Mamaroneck Ave., White Plains, N. Y.

MILLING MACHINES, Bed Type, Simplex, Duplex

Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
Cincinnati Milling & Grinding Mches., Inc., 470 Marburg Ave., Cincinnati 9, Ohio
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Espen-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.
Kearney & Trecker Corp., Milwaukee, Wis.
Motch & Merryweather Mchry. Co., 888 E. 70th St., Cleveland 3, Ohio
Sundstrand Mch. Tool Co., 2531 - 11th St., Rockford, Ill.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Circular, Continuous

Consolidated Mch. Tool Corp., Rochester, N. Y
Davis & Thompson Co., 6411 W. Burnham St. Milwaukee 14, Wis.
Espen-Lucas Mch. Works, Front St., and Girard Ave., Philadelphia, Pa.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Die Sinking, Duplicating, Profiling

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Calif.
Bridgeport Mches., Inc., 500 Lindley St., Bridgeport 6, Conn.
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Elox Corp. of Mich., 1830 Stephenson Highway, Royal Oak 3, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
G & L and Hypro Div., Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Gorton, George, Machine Co., 1110 W. 13th St., Racine, Wis.
Kearney & Trecker Corp., Milwaukee, Wis.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Sundstrand Mch. Tool Co., 2531 - 11th St., Rockford, Ill.

MILLING MACHINES, Knee Type, Horizontal, Plain, Universal

Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Calif.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bullard Co., Bridgeport 6, Conn.
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Greaves Machine Tool Div., 2009 Eastern Ave., Cincinnati, Ohio
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Homestrand, Inc., Larchmont, N. Y.
Kearney & Trecker Corp., Milwaukee, Wis.
Sheldon Machine Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Knee Type Rise and Fall

Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Homestrand, Inc., Larchmont, N. Y.
Kearney & Trecker Corp., Milwaukee, Wis.
Nichols-Morris Corp., 76 Mamaroneck Ave., White Plains, N. Y.

MILLING MACHINES, Knee Type Ram

Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
Gorton Mch. Co., 1321 Racine St., Racine, Wis.
Kearney & Trecker Corp., Milwaukee, Wis.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Knee Type, Turret

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gorton Mch. Co., 1321 Racine St., Racine, Wis.

MILLING MACHINES, Knee Type, Vertical

Atlas Press Co., Kalamazoo, Mich.
Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Calif.
Bridgeport Mches., Inc., 500 Lindley St., Bridgeport 6, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Cosa Corp., 450 Lexington Ave., New York 17, N. Y.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Homestrand, Inc., Larchmont, N. Y.
Kearney & Trecker Corp., Milwaukee, Wis.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
South Bend Lathe Wks., South Bend 22, Ind.

(*Continued on page 322*)

MILLING MACHINES, Planer Type
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Espen-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., Woodburn Ave. and Penn. R. R., Evanston, Cincinnati, Ohio
Kearney & Trecker Corp., Milwaukee, Wis.
Sundstrand Mch. Tool Co., 2531 - 11th St., Rockford, Ill.

MILLING MACHINES, Spar
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
G & L and Hypro Div., Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Kearney & Trecker Corp., Milwaukee, Wis.
Sundstrand Mch. Tool Co., 2531 - 11th St., Rockford, Ill.

MILLING MACHINES, Thread
Coulter Mch. Co., James, Bridgeport 5, Conn.
Lees-Bradner Co., The, Cleveland 11, Ohio

MOLDING MACHINES, Plastic
Baker Bros., Inc., 1000 Post St., Toledo 10, Ohio
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Engrg. Corp., 470 Woodward Ave., Buffalo 17, N. Y.

MOLYBDENUM
Climax Molybdenum Co., New York, N. Y.

MOTORS, Electric
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
General Electric Co., Schenectady, N. Y.
Howell Electric Motors Co., Howell, Mich.
Lincoln Electric Co., Cleveland 17, Ohio
Reliance Electric & Engrg. Co., 1074 Ivanhoe Rd., Cleveland 10, Ohio

MOTORS, Hydraulic
Barnes, J. S. Corp., Rockford, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hydraulic Press Mfg. Div., Mt. Gilead, Ohio
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Sundstrand Mch. Tool Co., 2531 - 11th St., Rockford, Ill.
Vickers, Inc., Detroit 32, Mich.

MULTIPLE INSPECTION GAGES—See Gages, Multiple Inspection

MULTIPLE-STATION MACHINES, Dial Type
Avey Drilling Mch. Co., 25 E. 3rd St., Covington, Ky.
Baker Bros., Inc., 1000 Post St., Toledo 10, Ohio
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Baush Mch. Tool Co., 15 Wason Ave., Springfield, Mass.
Bodine Corp., 317 Mt. Grove St., Bridgeport, Conn.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Federal Prod. Corp., 1144 Eddy St., Providence 1, R. I.
Greenlee Bros. & Co., 2136 - 12th St., Rockford, Ill.
Kingsbury Mch. Tool Corp., Keene, N. H.
La Salle Tool, Inc., 3840 E. Outer Drive, Detroit 34, Mich.
Michigan Drill Head Co., Van Dyke, Mich.
Millholland, W. K., Mchry. Co., Inc., Indianapolis 20, Ind.
Modern Industrial Engrg. Co., 14230 Birwood Ave., Detroit 38, Mich.
National Automatic Tool Co., S. 7th N. Sts., Richmond, Ind.
Snyder Tool & Engrg. Co., 3400 E. Lafayette Ave., Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 - 11th St., Rockford, Ill.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.

MULTIPLE-STATION MACHINES, Transfer Type
Avey Drilling Mch. Co., 25 E. 3rd St., Covington, Ky.
Baker Bros., Inc., 1000 Post St., Toledo 10, Ohio
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Baush Mch. Tool Co., 15 Wason Ave., Springfield, Mass.
Buhr Mch. Tool Co., 839 Green St., Ann Arbor Mich.
Bullard Co., Bridgeport 6, Conn.
Cincinnati Milling Mch. Co., Cincinnati 9, Ohio
Clearing Mch. Corp., 6499 W. 65th St., Chicago 38, Ill.
Davis & Thompson Co., 4460 N. 124th St., Milwaukee 10, Wis.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Greenfield Bros. & Co., 2136 - 12th St., Rockford, Ill.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Kearney & Trecker Corp., Milwaukee, Wis.
La Salle Tool, Inc., 3840 E. Outer Drive, Detroit 34, Mich.
Michigan Drill Head Co., Van Dyke, Mich.
Millholland, W. K., Mchry. Co., Inc., Indianapolis 20, Ind.
Modern Industrial Engrg. Co., 14230 Birwood Ave., Detroit 38, Mich.
Moline Tool Co., 102-20th St., Moline, Ill.
National Automatic Tool Co., S. 7th N. Sts., Richmond, Ind.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Snyder Tool & Engrg. Co., 3400 E. Lafayette Ave., Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 - 11th St., Rockford, Ill.
Verson Allsteel Press Co., 9399 S. Kenwood Ave., Chicago 19, Ill.

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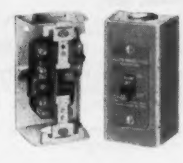
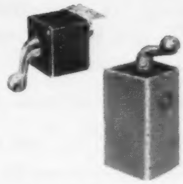
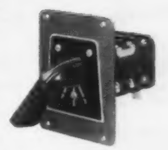
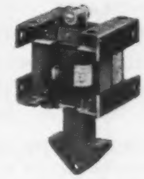
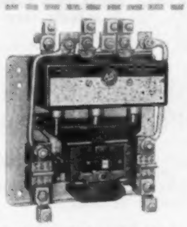

Bulletin 600 starter for motors of 1 hp or less. Overload protection

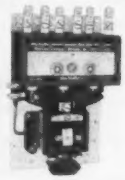

Bulletin 609 manual starters. Has overload breakers

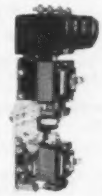

Bulletins 350-806 small rotary drum switches—all types

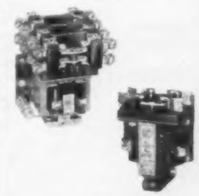

Bulletin 807 drum type small instrument switches

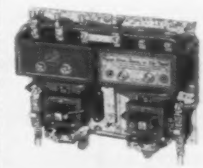

Bulletin 860 solenoids—9 sizes up to 1½ in. stroke

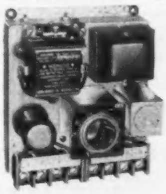

Bulletin 709 solenoid across-the-line magnetic starters

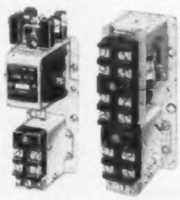

Bulletin 702 solenoid contactors up to 900 amperes

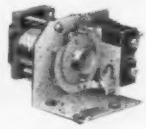

Bulletin 704 hum-free solenoid contactors with latch

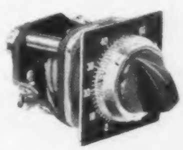

Bulletin 700 solenoid relays up to 8 poles—full line


Bulletin 705 reversing starters—elec. & mech. interlocked


Bulletin 852 electronic timer—¼ sec to 2 minutes


Bulletin 849 pneumatic timer—¼ sec to 3 minutes


Bulletin 850 timer—up to six reversals per minute


Bulletin 800TN4 potentiometer in oiltight mounting


Bulletin 808 plugging switch for stopping motors—no drift

USE ALLEN-BRADLEY CONTROL COMPONENTS ...COST NO MORE AND — THEY'RE TROUBLE FREE

All Allen-Bradley control panel components, such as relays, contactors, starters, timers, limit switches, etc., have been on the market for many years. They have been field tested in thousands of industrial applications. They are universally recognized as the QUALITY line of motor controls.

The Allen-Bradley Handy Catalog is an abbreviated encyclopedia on manual and automatic controls. It is an easy-to-use reference book, filled with specific data on all types of controls. Send for your copy . . . it will pay you to use this handbook on QUALITY motor controls. Write, today.

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1331 S. First St.
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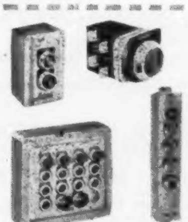
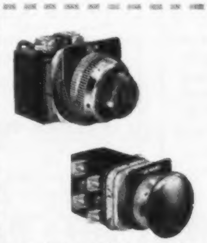
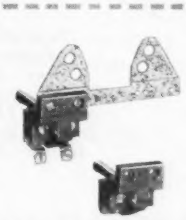
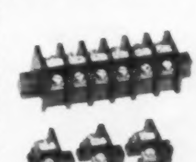

Bulletin 800T multibutton oiltight control stations


Bulletin 800T oiltight push buttons and pilot lights


Bulletin 895 auxiliary contacts for solenoid starters


Bulletin 802T limit switches—fixed or adjustable lever


Bulletin 892 handy terminal blocks for control panels

For more information fill in page number on Inquiry Card, on page 225

NAMEPLATES
Acromark Co., 9-11 Morrell St., Elizabeth, N. J.

NIBBLING MACHINES
Thor Power Tool Co., 175 N. State St., Aurora, Ill.
Wales-Strippet Corp., North Tonawanda, N. Y.

NICKEL AND NICKEL ALLOYS
Crucible Steel Co. of America, Henry W. Oliver Bldg., Mellon Square, Pittsburgh 22, Pa.

NUMBERING MACHINES
Acromark Co., 9-11 Morrell St., Elizabeth, N. J.

NUT SETTERS—See Screwdrivers, etc.

NUTS—See Bolt, Nuts and Screws

OIL EXTRACTORS
De Laval Separator Co., Poughkeepsie, N. Y.

OIL GROOVERS
Wicaco Machine Corp., Wayne Junction, Philadelphia, Pa.

OILERS AND LUBRICATORS
Gits Bros. Mfg. Co., 1858 S. Kilbourn Ave., Chicago, Ill.
Madison-Kipp Corp., Madison, Wis.
Wicaco Mch. Corp., Philadelphia, Pa.

OILS, CUTTING SOLUBLE—See Cutting and Grinding Fluids

OILS, Lubricating—See Lubricating Oils and Greases

OILS, Quenching and Tempering
Cities Service Oil Co., 70 Pine St., New York, N. Y.
Houghton & Co., E. F., 303 W. Lehigh Ave., Philadelphia, Pa.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Sinclair Refining Co., 600 - 5th Ave., New York, N. Y.
Standard Oil Co., (Indiana), 910 S. Michigan Ave., Chicago 80, Ill.
Stuart Oil Co., Ltd., D. A., 2739 S. Troy St., Chicago, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia 3, Pa.

OPTICAL FLATS
Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill.
DoAll Co., Des Plaines, Ill.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Van Keuren Co., Watertown 72, Mass.

ORDNANCE MACHINES, Special
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Michigan Drill Head Co., Detroit 34, Mich.
Milholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Rehnberg-Jacobson Mfg. Co., 2135 Kishwaukee St., Rockford, Ill.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.

PACKING, Leather, Metal, Rubber, Asbestos, Etc.
Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill.
Garlock Packing Co., Palmyra, N. Y.
Houghton & Co., E. F., 303 W. Lehigh Ave., Philadelphia, Pa.

PAINTING EQUIPMENT, Spray—See Spraying Equipment, Metal

PARALLELS
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., Des Plaines, Ill.
Starrett, The L. S., Co., Athol, Mass.
Walker, O. S., Co., Inc., Worcester Mass.

PATTERNS, Wood and Metal
Mummert-Dixon Co., Hanover, Pa.

PILLOW BLOCKS
Boston Gear Works, 3200 Main St., North Quincy 71, Mass.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Standard Pressed Steel Co., Jenkintown, Pa.

PIPE, Steel, Stainless, etc.
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., 105 W. Bern St., Reading, Pa.
Crucible Steel Co. of America, Henry W. Oliver Bldg., Mellon Square, Pittsburgh 22, Pa.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
United States Steel Corp., National Tube Co., Div., 436 7th Ave., Pittsburgh, Pa.

PIPE AND TUBING MILLS, Electric-weld
Yoder Co., 5504 Walworth Ave., Cleveland 2, Ohio

PIPE AND TUBING, Brass and Copper
American Brass Co., 25 Broadway, New York, N. Y.
Mueller Brass Co., 1925 Lapeer Ave., Port Huron, Mich.
Revere Copper & Brass, Inc., 230 Park Ave., New York 17, N. Y.

PIPE THREADING AND CUTTING MACHINES
Davis & Thompson Co., 4460 N. 124th St., Milwaukee 10, Wis.
Landis Machine Co., Inc., Waynesboro, Pa.
Sheffield Corp., Dayton 1, Ohio

PLANER JACKS—See Set-up Equipment

PLANERS, Double Housing and Openside
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Consolidated Mch. Tool Div., Rochester, N. Y.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., 3611 Woodburn Ave., Cincinnati, Ohio
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.

PLASTICS AND PLASTIC PRODUCTS
Dow Chemical Co., Midland, Mich.
Eastman Kodak Co., 343 State St., Rochester 4, N. Y.
Garlock Packing Co., Palmyra, N. Y.
Gisholt Mch. Co., Madison, Wis.
U. S. Steel Corp., Nat'l Tube Div., Pittsburgh, Pa.

PRESS BRAKES—See Brakes, Presses and Bending

PRESS FEEDERS, Automatic
Bliss Co., E. W., Canton, Ohio
U. S. Tool Co., East Orange, N. J.

PRESSES, Arbor
Acromark Co., 9-11 Morrell St., Elizabeth, N. J.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Dake Corp., 604 Seventh St., Grand Haven, Mich.
duMont Corp., Greenfield, Mass.
Farquhar, A. B., Div. Oliver Corp., York, Pa.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Threadwell Tap & Die Co., Greenfield, Mass.
Tomkins-Johnson Co., 614 No. Mechanic St., Jackson, Mich.
Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.

PRESSES, Broaching
American Broach & Mch. Co., Ann Arbor, Mich.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio
Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Dake Corp., 604 Seventh St., Grand Haven, Mich.
Farquhar, A. B., Div. Oliver Corp., York, Pa.
Federal Press Co., Elkhart, Ind.
Ferracute Machine Co., Bridgeton, N. J.
Lake Erie Engrg. Co., Kenmore Station, Buffalo, N. Y.
Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.

PRESSES, Extrusion
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio
Chambersburg Engrg. Co., Chambersburg, Pa.
Erie Foundry Co., Erie, Pa.
Farquhar, A. B., Div. Oliver Corp., York, Pa.
Federal Press Co., Elkhart, Ind.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Engrg. Co., Kenmore Station, Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.

(*Continued on page 328*)

Chances are at least

98 out of 100

that this part

will be **perfect**

The Metal Stampings Plant, Sylvania Electric Products, Inc., keeps rejects under 2%—even on complex, close-tolerance parts produced at rates to 9,000 per hour. Optical gaging helps set this level.

The diode plate shown above is an example of the complex, mass-produced, parts turned out to close tolerances by The Metal Stampings Plant, Sylvania Electric Products, Inc., at York, Pennsylvania. Tolerances run to ± .001″; as many as 10 dimensions must be held, including inner and outer diameters. Yet even on parts more difficult than this—parts with tolerances of .0005″ and forming rates of 9,000 per hour—Sylvania gets an acceptance rate of over 98%.

Inspection on Kodak Contour Projectors helps Sylvania do the job to the satisfaction of its customers, both internal and external. Operators check the first parts produced by every machine to assure correct setup. Then, throughout the run, production samples are checked at regular intervals—making certain each machine is holding to tolerance. The speed with which these parts can be checked using optical gaging methods has helped slash rejection rates more than 50% since Kodak Contour Projectors were installed.

If you have difficult inspection problems involving quantity, speed, close tolerances or hard-to-measure dimensions like shoulders, holes, radii or angles, there's every reason to expect a solution by optical gaging on a Kodak Contour Projector. There's a representative in your area who can tell you more. To get in touch with him, or for a copy of the booklet, "Projection Gaging with Kodak Contour Projectors," write Special Products Sales Division.

Little training is required to operate a Kodak Contour Projector. Operators sit comfortably in a fully lighted room. The work gets out in a hurry.

EASTMAN KODAK COMPANY, Rochester 4, N. Y.

the KODAK CONTOUR PROJECTOR

Kodak
TRADE-MARK

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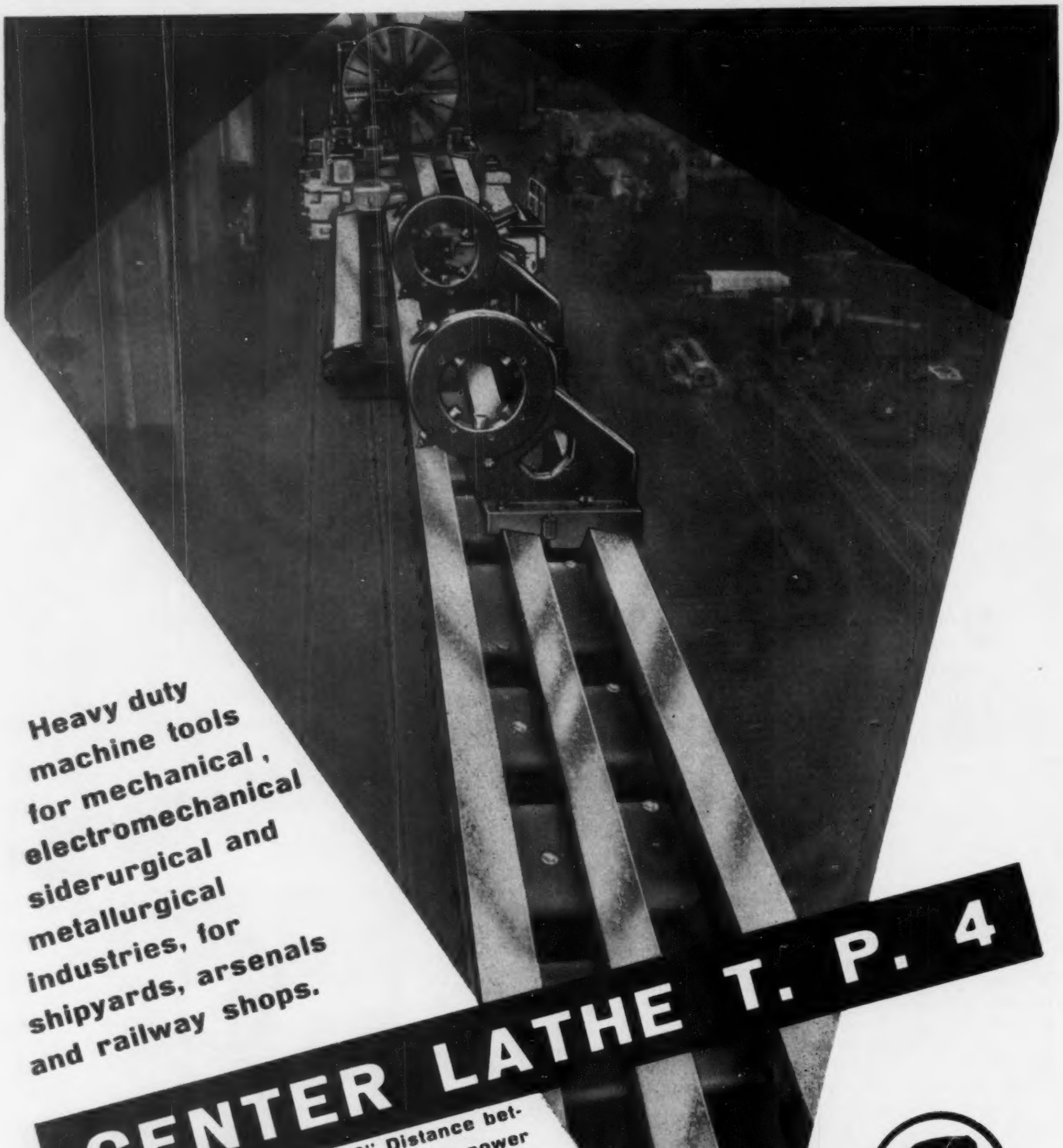

Heavy duty machine tools for mechanical, for electromechanical siderurgical and metallurgical industries, for shipyards, arsenals and railway shops.
CENTER LATHE T. P. 4
Swing over bed 120" Distance between centers 50' Main motor power HP 180 Weight of the machine 200 Tons Admitted weight on centers 100 Tons
SE

PRESSES, Foot

Acromark Co., 9-11 Morrell St., Elizabeth, N. J.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio
Ferracute Machine Co. Bridgeton, N. J.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.

PRESSES, Forging

Ajax Mfg. Co., Euclid, Cleveland 17, Ohio
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Bliss Co., E. W., 1375 Raff Rd., S. W. Canton, Ohio
Clearing Mch. Corp., Div. U. S. Industries, Inc., 6499 W. 65th St., Chicago, Ill.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E. Cleveland, Ohio
Dake Corp., 604 Seventh St., Grand Haven, Mich.
Erie Foundry Co., Erie, Pa.
Farquhar, A. B., Div. Oliver Corp., York, Pa.
Ferracute Machine Co., Bridgeton, N. J.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St., and S. Kenwood Ave., Chicago, Ill.
Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.

PRESSES, Hydraulic

American Broach & Mch. Co., Ann Arbor, Mich.
Anderson Bros., Mfg. Co., 1910 Kishwaukee St., Rockford, Ill.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Milling Machine Co., Process Machinery Div., Cincinnati 9, Ohio
Clearing Mch. Corp., Div. U. S. Industries, Inc., 6499 W. 65th St., Chicago, Ill.
Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Dake Corp., 604 Seventh St., Grand Haven, Mich.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio
Detroit Broach Co., (special & semi-special) P. O. Box 156, Rochester, Mich.
Erie Foundry Co., Erie, Pa.
Farquhar, A. B., Div. Oliver Corp., York, Pa.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Federal Mch. & Welder Co., Warren, Ohio
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.
Niagara Machine & Tool Works, 683 Northland Ave., Chicago, Ill.
Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.

PRESSES, Screw

Bliss Co., E. W., 1375 Raff Rd., S. W. Canton, Ohio
Dake Corp., 604 Seventh St., Grand Haven Mich.
Ferracute Machine Co., Bridgeton, N. J.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.

PRESSES, Sheet Metal Working

Allen, Alva F., Box 426 Clinton, Mo. (Bench)
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Baldwin-Lima-Hamilton Corp., Lima-Hamilton Div., Hamilton, Ohio
Bath, Cyril Co., Aurora & Solon Road, Solon, Ohio
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Milling Machine Co., Process Machinery Div., Cincinnati 9, Ohio
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio
Clearing Mch. Corp., Div. U. S. Industries, Inc., 6499 W. 65th St., Chicago, Ill.
Cleveland Crane & Engrg. Co., Wickliffe, Ohio
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio
Consolidated Mch. Tool Corp., Rochester, N. Y.
Dake Corp., 604 Seventh St., Grand Haven, Mich.
Danly Machine Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 50, Ill.
Erie Foundry Co., Erie, Pa.
Espen-Lucas Machine Works, Front St., and Girard Ave., Philadelphia, Pa.
Farquhar, A. B., Div. Oliver Corp., York, Pa.
Federal Machine & Welder Co., Overland Ave., Warren, Ohio
Federal Press Co., Elkhart, Ind.
Ferracute Machine Co., Bridgeton, N. J.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Johnson Machine & Press Corp., Elkhart, Ind.
L & J Press Corp., Elkhart, Ind.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Verson Allsteel Press Co., 93rd and S. Kenwood Ave., Chicago, Ill.
Wales-Strippet Corp., North Tonawanda, N. Y.
Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.

PRESSES, Straightening

Anderson Bros. Mfg. Co. 1910 Kishwaukee St., Rockford, Ill.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Chambersburg Engrg. Co., Chambersburg, Pa.
Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Dake Corp., 604 Seventh St., Grand Haven, Mich.
Erie Foundry Co., Erie, Pa.
Farquhar, A. B., Div. Oliver Corp., York, Pa.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Eng. Corp., 470 Woodward Ave., Buffalo, N. Y.
Niagara Machine & Tool Works, (Hydraulic), 683 Northland Ave., Buffalo, N. Y.
Springfield Mch. Tool Co., Springfield, Ohio
Verson Allsteel Press Co., 93rd St. & Kenwood Ave., Chicago, Ill.
Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.

PROFILING MACHINES—See Milling Machine, Die Sinking, etc.

PULLEYS

Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.

PUMPS, Coolant and Lubricant

Barnes, John S., Corp., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Gray-Mills Co., 3705 N. Lincoln Ave., Evanston, Ill.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Ruthman Machinery Co., 1809 Reading Rd., Cincinnati 12, Ohio
Viking Pump Co., Cedar Falls, Iowa

PUMPS, Hydraulic

Barnes, J. S., Corp., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio
Hydraulic Press Mfg. Div., Mount Gilead, Ohio
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Vickers Incorporated, Division of Sperry Rand Corp., 1402 Oakman Blvd., Detroit, Mich.
Viking Pump Co., Cedar Falls, Iowa
Wilson, K. R., Arcade, N. Y.

PUNCHES AND DIES—See Dies, Blanking, etc.

REAMERS, Rose, Chucking, Jobbers', Taper, Shell, Adjustable, etc.

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Goddard & Goddard Co., Detroit, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
Heller Tool Co., Heller Dr., Newcomerstown, Ohio
McCrosky Tool Corp., Meadville, Pa.
National Twist Drill & Tool Co., & Winter Bros. Co., Rochester, Mich.
Star Cutter Co., 34500 Grand River, Farmington, Mich.
Tomkins-Johnson Co., 617 N. Mechanic St., Jackson, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

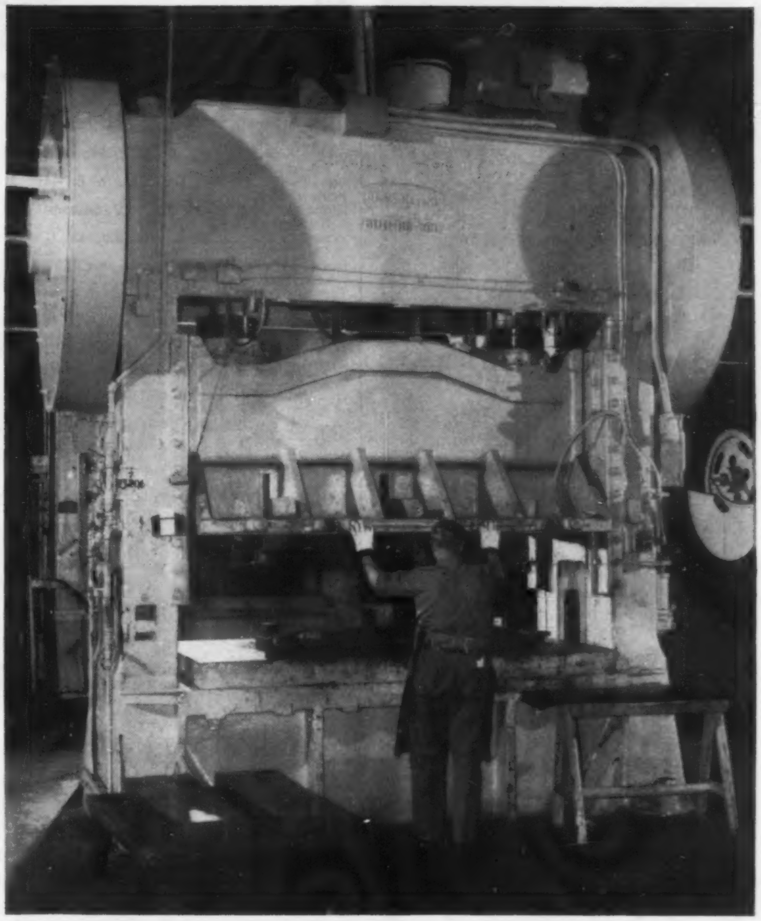
REELS, Stock

National Acme Co., 170 E. 131st St., Cleveland 3, Ohio
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

REFRACTORS, Heat-Treating Furnaces

Norton Co., 1 New Bond St., Worcester 6, Mass.

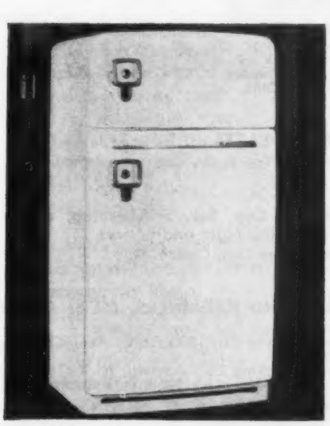
(Continued on page 330)



The Cleveland Double-Crank Press shown here draws more than seven parts for the famous Servel Refrigerator.

SERVEL, INC. finds Cleveland Presses

"require very little maintenance . . . have no clutch problems"



Installed in the Home Appliance Division of SERVEL, INC., Evansville, Indiana, in March of 1951, the Cleveland Double Crank Press you see here has been constantly "on the job" producing parts for famous Servel refrigerators.

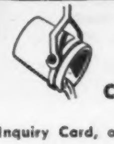
Carl Linke, Foreman of the Sheet Metal Department, says, "This Cleveland 80D is a good press. We've used it for most of our draw work for the past five years. During this time it has required very little maintenance. We've had no clutch maintenance problems."

As have many of the nation's leading stamping departments, you, too, will find that Cleveland Presses prove themselves to be easy-to-maintain, low-cost producers. Before buying your next press be sure you have the complete Cleveland story. One of the 11 specialized types of Cleveland Presses is sure to be your answer to greater stamping economy. Write or call today!

THE CLEVELAND PUNCH & SHEAR WORKS CO.

Established 1880

POWER PRESSES – FABRICATING TOOLS



E. 40th & St. Clair Avenue, Cleveland 14, Ohio

Offices at: NEW YORK • CHICAGO • DETROIT • PHILADELPHIA • E. LANSING

CITY FOUNDRY DIVISION • SMALL TOOL DEPARTMENT

For more information fill in page number on Inquiry Card, on page 225

RETAINING RINGS FOR BEARINGS, Etc.

Waldes-Kohinoor, Inc., 4716 Austel Place, Long Island City 1, N. Y.

RIVETERS, Stationary

Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Grant Mfg. & Mch. Co., 90 Silliman Ave., Bridgeport 5, Conn.
Hannifin Corp., 510 S. Wolf Rd., Des Plaines, Ill.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Tomkins-Johnson Co., 617 N. Mechanic St., Jackson, Mich.

RIVETERS, Portable

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Hannifin Corp., 510 So. Wolf Rd., Des Plaines, Ill.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Thor Power Tool Co., Aurora, Ill.

RULES, SCALES AND STRAIGHTEDGES—See Machinists' Small Tools

RUST INHIBITORS

Houghton, E. F. & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Oakite Products, Inc., 19 Rector St., New York N. Y.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Sun Oil Co., 1608 Walnut St., Philadelphia 3, Pa.

SAND BLAST EQUIPMENT—See Blast Cleaning Equipment

SAW BLADES, Hack, Band, Circular, Friction

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Circular Tool Co., Inc., 765 Allens Ave., Providence 5, R. I.
DoALL Co., 254 Laurel Ave., Des Plaines, Ill.
Espen Lucas Mch. Works, Philadelphia, Pa.
Motch & Merryweather Mchy. Co., 888 E. 70th St., Cleveland 3, Ohio
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Starrett, The L. S. Co., Athol, Mass.
Tannewitz Wks., Grand Rapids, Mich.

SAW BLADE SHARPENERS

DoALL Co., Des Plaines, Ill.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

SAWING MACHINES, Abrasive Machines—See Cutting-off Saws, Abrasive Wheel

SAWING MACHINES, Band

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
DoALL Co., 254 Laurel Ave., Des Plaines, Ill.
Tannewitz Wks., Grand Rapids, Mich.

SAWING MACHINES, Circular Blade

Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
DoALL Co., 254 Laurel Ave., Des Plaines, Ill.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio

SAWING MACHINES, Power Hack

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Chicago Pneumatic Tool Co., New York 17, N. Y.
Homestrand, Inc., Larchmont, N. Y.
Thor Power Tool Co., 175 N. State St., Aurora, Ill.

SAWS, Screw-slotting—See Cutters, Milling

SCALES

Hydroway Scales, Inc., 20618 W. Eight Mile Rd., Detroit, Mich.

SCREW DRIVERS, STUD AND NUT SETTERS, Power

Bodine Corp., 317 Mt. Grove St., Bridegport 5, Conn.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Errington Mech. Lab., Inc., 24 Norwood Ave., Staten Island 4, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Scully-Jones & Co., 1906 S. Rockwell St., Chicago 8, Ill.
Thor Power Tool Co., Aurora, Illinois
Williams & Co., J. H., 400 Vulcan St., Buffalo 7, N. Y.

SCREW MACHINES, Hand—See Lathes, Turret, Ram-type, Saddle-type

SCREW MACHINES, Single-Spindle Automatic

Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio
Cone Automatic Mch. Co., Inc., Windsor, Vt.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gear Grinding Mch. Co., 3901 Christopher St., Detroit 11, Mich.
Gisholt Mch. Co., 1245 E. Washington Ave., Madison 10, Wis.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine Wis.
National Acme Co., 170 E. 131st St., Cleveland, Ohio
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., N. Y. 17, N. Y.

SCREW MACHINES, Multiple-Spindle Automatic

Cone Automatic Mch. Co., Inc., Windsor, Vt.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Greenlee Bros. & Co., 2136 12th St., Rockford, Ill.
National Acme Co., 170 E. 131st St., Cleveland, Ohio
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Warner & Swasey, 6701 Carnegie Ave., Cleveland 3, Ohio

SCREW PLATES

Greenfield Tap & Die Corp., Greenfield, Mass.

SCREWS, Cap, Set, Self-tapping, etc.—See Bolts, Nuts and Screws

Parker Kalon Div., Clifton, N. J.

SEALS AND RETAINERS, Oil or Grease

American Felt Co., Glenville, Conn.
Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill.
Garlock Packing Co., Palmyra, N. Y.
Gits Bros. Mfg. Co., 1858 S. Kilbourn Ave., Chicago, Illinois

SEPARATORS, Centrifugal

DeLaval Separator Co., Poughkeepsie, N. Y.

SEPARATORS, Magnetic

Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

(Continued on page 332)

For more information fill in page number on Inquiry Card, on page 225

SET-UP EQUIPMENT
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Challenge Mchry. Co., Grand Haven, Mich.
Starrett, The L. S., Co., Athol, Mass.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

SHAFTS
Cumberland Steel Co., 101 Williams St., Cumberland, Md.
National Forge & Ordnance Co., Irvine, Warren County, Pa.
Thomson Ind., Inc., Manhasset, N. Y.

SHAPERS, Crank and Hydraulic
Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio
Homestrand, Inc., Larchmont, N. Y.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Western Machine Tool Works, Holland, Mich.

SHAPERS, Vertical and Slotters
Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Bridgeport Mches., Inc., 500 Lindley St., Bridgeport 6, Conn.
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Homestrand, Inc., Larchmont, N. Y.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.

SHEARS, Alligator
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Lodge & Shipley Co., The, Cincinnati 25, Ohio

SHEARS, Rotary and Squaring
Birdsboro Steel Fdy. & Mch. Co., Birdsboro, Pa.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Shaper Co., Hopple & Garrard, Cincinnati 25, Ohio
Johnson Mch. & Press Corp., 620 W. Indiana Ave., Elkhart, Ind.
Lodge & Shipley Co., The, Cincinnati 25, Ohio
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Simonds Saw & Steel Co., (Knives), 470 Main St., Fitchburg, Mass.

SHEARS, Squaring
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio
Lodge & Shipley Co., The, Cincinnati 25, Ohio
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Simonds Saw & Steel Co., (Blades), 470 Main St., Fitchburg, Mass.

SHEET METALS—See Strip and Sheet, Ferrous, Non-ferrous

SHIM STOCK
Laminated Shim Co., Inc., Glenbrook, Conn.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.

SHOP FURNITURE—See Furniture, Shop

SLITTING MACHINES, Rotary
Bliss Co., E. W., Canton, Ohio
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo 11, N. Y.
Yoder Co., 5504 Walworth Ave., Cleveland 2, Ohio

SLOTTERS—See Shapers, Vertical and Slotters

SOLENOIDS
Allen-Bradley Co., 1331 S. 1st St., Milwaukee 4, Wis.
Barnes, John S. Corp., Rockford, Ill.
General Electric Co., Schenectady, N. Y.
National Acme Co., 170 E. 131st St., Cleveland 3, Ohio
Vickers, Inc., Detroit 32, Mich.

SOCKETS—See Drill Sleeves and Extension Holders

SPECIAL MACHINERY AND TOOLS
Acromark Co., 9-11 Morrell St., Elizabeth, N. J.
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Baker Bros., Inc., Sta. F., P.O. Box 101, Toledo 10, Ohio.
Bath, Cyril Co., Aurora & Solon Road, Solon, Ohio

(Continued on page 334)

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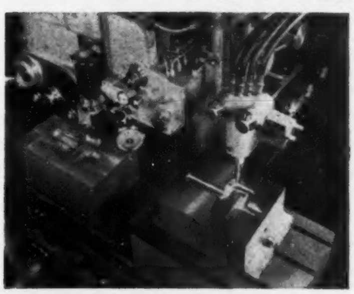

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39 Years Experience

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Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Bethlehem Steel Co., Bethlehem, Pa.
Bilgram Gear & Mch Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Birdsboro Steel Fdy. & Mch. Co., Birdsboro, Pa
Blanchard Mch. Co., 64 State St., Cambridge, Mass.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
Colonial Broach & Machine Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
Columbus Die-Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. C
Coulter, James, Machine Co., Bridgeport 5 Conn.
Cross Co., Detroit, Mich.
Erie Foundry Co., Erie, Pa.
Espen-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Federal Machine & Welder Co., Overland Ave., Warren, Ohio.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Greenlee Bros., & Co., 12th and Columbia Aves, Rockford, Ill.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Hydraulic Press Mfg., Co., Mount Gilead, Ohio
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kingsbury Mch. Tool Corp., Keene, N. H.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Mercury Engrg. Corp., Milwaukee, Wis.
Michigan Drill Head Co., Detroit 34, Mich.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Modern Industrial Engrg. Co., 14230 Birwood, Detroit 4, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
National Automatic Tool Co., Inc., S 7th and N Sts., Richmond, Ind.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
National Twist Drill & Tool Co., Rochester, Mich.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio
Sundstrand Mch. & Tool Co., 2531 11th St., Rockford, Ill.
Universal Engrg. Co., Frankenmuth 2, Mich.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.
Waltham Machine Works, Newton St., Waltham, Mass.
Wicaco Machine Corp., **Wayne Junction, Philadelphia, Pa.**
Zagar Tool Co., 24000 Lakeland Blvd., Cleveland 23, Ohio

SPEED REDUCERS

Barnes, John S. Corp., Rockford, Ill.
Boston Gear Works, 320 Main St., North Quincy 71, Mass.
Brad Foote Gear Works, 1309 So. Cicero Ave., Chicago 50, Ill.
Cleveland Worm & Gear Co., 3249 E. 80th St., Cleveland, Ohio
DoALL Co., Des Plaines, Ill.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
General Electric Co., Schenectady, N. Y.
Horsburgh & Scott Co., 5114 Hamilton, Cleveland, Ohio
Philadelphia Gear Works, Inc., Erie Ave., and G St., Philadelphia, Pa.
Reliance Elec. & Engrg. Co., 1200 Ivanhoe Rd., Cleveland 10, Ohio

SPINDLES, Machine

Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Michigan Drill Head Co., Van Dyke, Mich.
National Automatic Tool Co., S. 7th St.-N St., Richmond, Ind.
Pope Mchry. Corp., Haverhill, Mass.
Standard Electrical Tool Co., 2488-90 River Road, Cincinnati, Ohio
Wadell Equip. Co., Clark, N. J.

SPRAYING EQUIPMENT, Metal

Metallizing Engrg. Co., Westbury, N. Y.

SPROCKETS—See Gears, Cut

STAMPINGS, Sheet Metal

Laminated Shim Co., Inc., Glenbrook, Conn.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

STEEL, Cold Rolled, Stainless, High-Speed, Tool, Etc.

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., 105 W. Bern St., Reading, Pa.
Columbia Tool Steel Co., Chicago Hts., Ill.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Cumberland Steel Co., 101 Williams St., Cumberland, Md.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Timken Roller Bearing Co., Canton, Ohio
U. S. Steel Corp., (American Steel & Wire Co.), Div., 436 7th Ave., Pittsburgh, Pa.
Vanadium-Alloys Steel Co., Latrobe, Pa.

STEEL DISTRIBUTORS

Ryerson, Jos. T., & Son, 16th & Rockwell St., Chicago 8, Ill.

STOCKS AND DIES

Cyril Bath Co., Solon, Ohio
DoALL Co., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Landis Mch. Co., Waynesboro, Pa.
Threadwell Tap & Die Co., Greenfield, Mass.

STRAIGHTEDGES—See Machinists' Small Tools

STRAIGHTENERS, Flat Stock and Wire

Bliss Co., E. W., Canton, Ohio
Lewis Machine Co., 3441 E. 76th St., Cleveland 27 Ohio
Niagara Mch. & Tool Wks., 637-697 Northland Ave., Buffalo 11, N. Y.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.

STRIP AND SHEET, Ferrous

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., 105 W. Bern St., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.

Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp., Div., Columbia Steel Co., Div., Tennessee Coal, Iron & R. R. Co., Div.), 436 7th Ave., Pittsburgh, Pa.

STRIP AND SHEET, Non-ferrous

American Brass Co., 25 Broadway, New York, N. Y.
Bethlehem Steel Co., Bethlehem, Pa.
Bridgeport Brass Co., Bridgeport, Conn.
New Jersey Zinc Co., 160 Front St., New York N. Y.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

STRUCTURAL SHAPES

Bethlehem Steel Co., Bethlehem, Pa.
Revere Copper & Brass, Inc., 230 Park Ave., New York 17, N. Y.
Ryerson, Jos. T., & Son, Inc. 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., 525 Wm. Penn Pl., Pittsburgh 30, Pa.

STUD SETTERS—See Screwdrivers, etc

SUPERFINISHING EQUIPMENT

Gisholt Machine Co., 1245 E. Washington Ave. Madison 10, Wis.

SURFACE PLATES

Brown & Sharpe Mfg. Co., 235 Promenade St. Providence 1, R. I.
Bryant Chucking Grinder Co., Springfield, Vt
Challenge Mchy. Co., Grand Haven, Mich.
Delta Power Tool Div., Rockwell Mfg. Co Pittsburgh, Pa
DoAll Co., Des Plaines, Ill.
South Bend Lathe Wks., South Bend 22, Ind

SWITCHES, Limit

Allen-Bradley Co., 1331 So. 1st St., Milwaukee Wis.
Doelcam Div. of Minneapolis-Honeywell, 1400 Soldiers Field Rd., Boston 25, Mass.

TACHOMETERS—See Indicators, Speed

TAP HOLDERS

Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
Cleveland Automatic Mch. Co., 4932 Beech St., Cincinnati 12, Ohio
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Michigan Drill Head Co., Van Dyke, Mich.
National Automatic Tool Co., S. 7th - N Sts., Richmond, Ind.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.

TAPPING HEADS

Baker Bros., Inc., Station F, P. O. Box 101, Toledo 10, Ohio
Davis Boring Tool Div., Giddings & Lewis Mch Tool Co., Fond du Lac, Wis.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, Staten Island, N. Y.
Ettco Tool Co., Inc., 592 Johnson Ave., Brooklyn, N. Y.
Homestrand, Inc., Larchmont, N. Y.
La Salle Tool, Inc., 3840 E. Outer Drive, Detroit 34, Mich.
Leland-Gifford Co., 1425 Southbridge St., Worcester, Mass.
Michigan Drill Head Co., 11449 Timken Ave., Van Dyke, Mich.
Millholland Mchy Co., W.K.M., Indianapolis 20, Ind.
National Automatic Tool Co., S. 7th - N Sts., Richmond, Ind.
Thriftmaster Products Corp., 1076 N. Plum St., Lancaster, Pa.
Zagar Co., 24000 Lakeland Blvd., Cleveland 23, Ohio

TAPPING MACHINES

Baker Bros., Inc., Station F, P. O. Box 101, Toledo 70, Ohio
Baush Machine Tool Co., 15 Wason Ave Springfield 7, Mass.
Bodine Corp., 317 Mt. Grove St., Bridgeport Conn.
Cincinnati Bickford Div. Giddings & Lewis Mch. Tool Co., Oakley, Cincinnati 9, Ohio
Chicago Pneumatic Tool Co., New York 17, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Edlund Mchry. Co., 37 Huntington St., Cortland, N. Y.
Elox Corp. of Mich., 1830 Stephenson Highway, Royal Oak 3, Mich.
Ettco Tool Co., Inc., 592 Johnson Ave., Brooklyn, N. Y.
Govro-Nelson Co., 1931 Antoinette St., Detroit 8, Mich
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Ingersoll-Rand Co. 11 Broadway, New York 4, N. Y
Kaufman Manufacturing Co., Manitowoc, Wis
Kingsbury Mch. Tool Corp., Keene, N. H.
Landis Mch. Co., Waynesboro, Pa.
La Salle Tool Inc., 3840 E. Outer Drive, Detroit 34, Mich.
Michigan Drill Head Co., Van Dyke, Mich.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Moline Tool Co., 102 20th St., Moline, Ill
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio
National Automatic Tool Co., Inc., S. 7th and N Sts., Richmond, Ind.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio
Western Machine Tool Works, Holland, Mich.
Zagar Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio

TAPS, Hand, Machine Screw, Pipe, etc.

Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Threadwell Tap & Die Co., Greenfield, Mass.
Winter Bros. Co., Rochester, Mich.

TAPS, Collapsing

Greenfield Tap & Die Corp., Greenfield, Mass.
Landis Mch. Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio

THREAD CUTTING MACHINES

Coulter, James Machine Co., Bridgeport 5, Conn.
Davis & Thompson Co., 4460 W. 124th St., Milwaukee 10, Wis.
Eastern Mch. Screw Corp., New Haven, Conn.
Errington Mach. Lab. Inc., 24 Norwood Ave., Staten Island 4, N. Y.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Landis Mch. Co., Waynesboro, Pa.
Lees-Bradner Co., Cleveland, Ohio
Michigan Drill Head Co., Van Dyke, Mich.
Sheffield Corp., Dayton 1, Ohio

THREAD CUTTING TOOLS

Armstrong Bros. Tool Co., 5200 Armstrong Ave., Chicago, Ill.
Coulter, James, Machine Co., Bridgeport 5, Conn.
Eastern Mch. Screw Corp., New Haven, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Landis Mch. Co., Waynesboro, Pa.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Star Cutter Co., 34500 Grand River, Farmington, Mich.

THREAD ROLLING DIES—See Dies, Thread Rolling

(Continued on page 336)

THREAD ROLLING EQUIPMENT

Landis Machine Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland 3, Ohio
Reed Rolled Thread Die Co., P. O. Box 350, Worcester 1, Mass.
Sheffield Corp., Dayton 1, Ohio

TOOL CONTROL BOARDS

Cross Co., 3250 Bellevue, Detroit 7, Mich.
Royal Design & Mfg. Inc., 4133 E. 10 Mile Rd., Centerline, Mich.
Scully-Jones Co., 1906 S. Rockwell St., Chicago 8, Ill.

TOOL HOLDERS

Apex Tool & Cutter Co., Inc., 235 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Besly-Welles Corp., 112 Dearborn Ave., So. Beloit, Ill.
Bridgeport Mches, Inc., 500 Lindley St., Bridgeport 6, Conn.
Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
Cleveland Automatic Mch. Co., 4932 Beech St., Cincinnati 12, Ohio
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Eastern Mch. Screw Corp., Truman & Barclay Sts., New Haven 6, Conn.
Eclipse Counterbore Co., 1600 Bonner Ave., Ferndale, Mich.
McCrosky Tool Corp., Meadville, Pa.
Metal Carbides Corp., 6001 Southern Blvd., Youngstown 12, Ohio
R & L Tools, 1825 Bristol St., Philadelphia 40, Pa.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill. (Turret)
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

TOOL MATERIAL, Cast Non-Ferrous Alloy

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Haynes Stellite Co., 725 So. Lindsay St., Kokomo, Ind.

TOOL MATERIAL, Cemented Carbide

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Apex Tool & Cutter Co., Inc., 235 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5213 W. Armstrong Ave., Chicago 30, Ill.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Eclipse Counterbore Co., 1600 Bonner Ave., Ferndale, Mich.
Kennametal, Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown 12, Ohio
Spiral Step Tool Co., Chicago 25, Ill.
Star Cutter Co., 34500 Grand River, Farmington, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

TOOL MATERIAL, Ceramic

Metal Carbides Corp., Youngstown 12, Ohio
Norton Co., 1 New Bond St., Worcester 6, Mass.

TOOL MATERIAL, High-Speed Steel

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Apex Tool & Cutter Co., Inc., 235 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5213 W. Armstrong Ave., Chicago 30, Ill.
Carpenter Steel Co., Reading, Pa.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
du Mont Corp., 289 Wells St., Greenfield, Mass.
Eclipse Counterbore Co., 1600 Bonner Ave., Detroit 30, Mich.
Spiral Step Tool Co., 5400 N. Damen Ave., Chicago 25, Ill.
Star Cutter Co., 34500 Grand River, Farmington, Mich.
Vanadium Alloys Steel Co., Latrobe, Pa.

TRACING ATTACHMENTS

American Tool Works Co., Cincinnati 2, Ohio
Atlas Press Co., Kalamazoo, Mich.
Gisholt Mch. Co., 1245 E. Washington Ave., Madison 10, Wis.
Gorton Mch. Co., 1321 Racine St., Racine, Wis.
Jones & Lamson Mch. Co., 512 Clinton St., Springfield, Vt.
Sidney Mch. Tool Co., Sidney, Ohio
Wales-Strippit Co., N. Tonawanda, N. Y.
Warner & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio

TRANSFER MACHINES, Automatic—See Multiple-Station Machines

TRANSMISSION, Variable Speed

Barnes, John S. Corp., Rockford, Ill.
Boston Gear Wks., Quincy, Mass.
Cleveland Worm & Gear Co., 3249 E. 80th St., Cleveland 4, Ohio
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Reliance Electric & Engrg. Co., 1047 Ivanhoe Rd., Cleveland 10, Ohio
Vickers, Inc., Detroit 32, Mich.

TRUCKS, Material Handling

Hamilton Tool Co., 834 So. 9th St., Hamilton, Ohio

TUBE-FLANGING MACHINES

Grant Mfg. & Mch. Co., 90 Silliman Ave., Bridgeport 5, Conn.
Niagara Mch. & Tool Wks., 637-697 Northland Ave., Buffalo 11, N. Y.

TUBE FORMING AND WELDING MACHINES

Yoder Co., 550 Walworth Ave., Cleveland, Ohio

TUBE MILLS

Etna Machine Co., Perrysburg, Ohio
Yoder Co., 550 Walworth Ave., Cleveland, Ohio

TUBING, Non-ferrous

American Brass Co., 25 Broadway, New York, N. Y.
Bridgeport Brass Co., Bridgeport, Conn.
Mueller Brass Co., Port Huron 34, Mich.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.
Ryerson & Son, Inc., Jos. T., 2558 W. 16th St., Chicago 18, Ill.

TUBING, Steel

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Henry W. Oliver Bldg., Mellon Square, Pittsburgh 22, Pa.
National Tube Div., U. S. Steel Corp., 525 Wm. Penn Place, Pittsburgh, Pa.
Revere Copper & Brass, Inc., 230 Park Ave., New York 17, N. Y.
Ryerson, Jos. T. & Son, 2559 W. 16th St., Chicago 18, Ill.
Timken Roller Bearing Co., Canton, Ohio

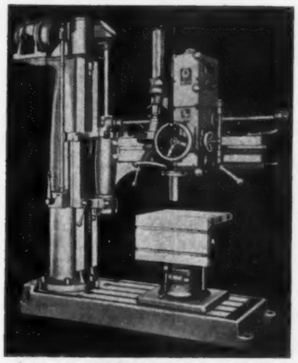
ULTRASONIC MCH. TOOLS

Sheffield Corp., Dayton 1, Ohio

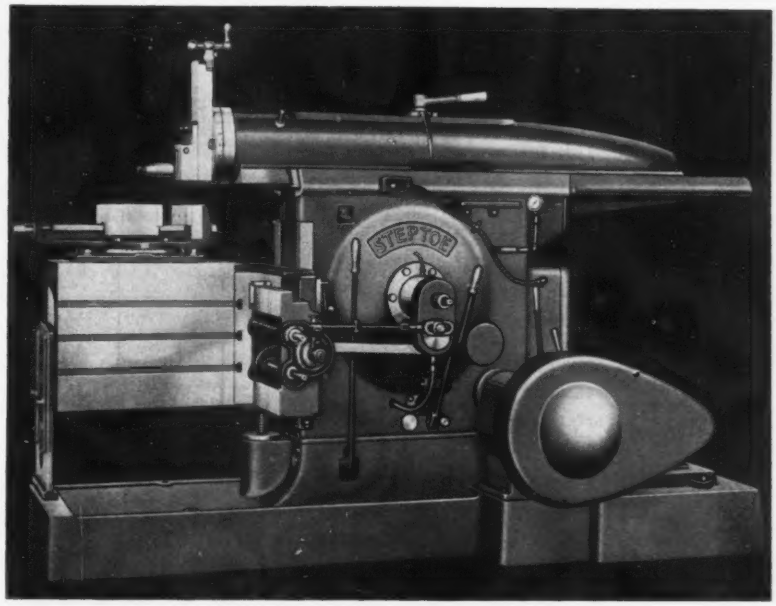
UNIT HEATERS, Electric

General Electric Co., Schenectady, N. Y.

(Continued on page 338)



WESTERN RADIAL DRILLS—Heavy Duty, 3 to 8 ft., 16 or 32 speeds. High Speed, 3 to 6 ft., 6, 9, 12 or 18 speeds.



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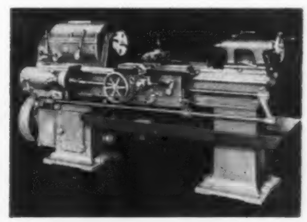
"RELIABLE—SINCE 1895"

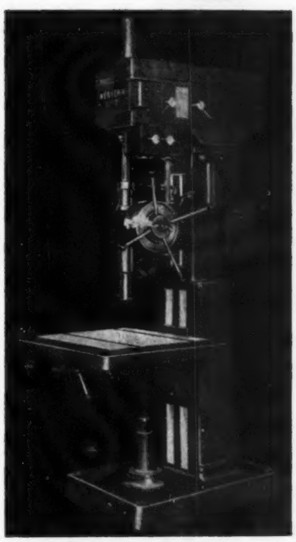
STEPTOE SHAPERS—Heavy Duty—4 or 8 speeds—Timken bearing equipped—14", 16", 20" and 24" sizes.

STEPTOE-WESTERN SHAPERS—Medium duty—4, 9 or 18 speeds up to 200 strokes per minute—12" and 15" sizes.



CHARD LATHES — Quick change, geared head; 16", 18" and 20" swing, 8 or 12 speeds.

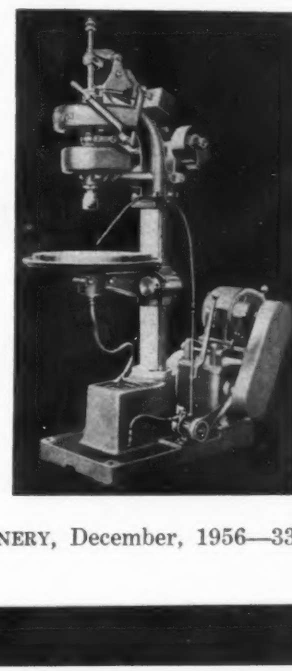
GARVIN AUTOMATIC TAPPERS—Up to 3" pipe tap capacity; four spindle speeds.



WESTERN UPRIGHT DRILLS—Single or multiple spindle; 18 speeds; 9 feeds; all geared; up to 2½" capacity.

STEPTOE HEAVY DUTY SHAPERS have proven, accurate features, with a simplicity of component parts and absence of gadget attachments, and therefore have a very low maintenance cost and long life. All drive shafts, and the bull gear, are mounted on Timken bearings within dust-proof housings, and are supplied with an automatic forced feed lubricating system when so ordered. All gears within the speed box are of alloy steel, generated on Fellows Shapers, and chamfered where required for easy sliding engagement. Four speed changes within the speed box, combined with sliding back gears within the column, produce eight ram speeds in progression. All speed changes may be made while the machine is running, without clashing of different gear ratios. Also available in 12" & 15" High Speed, medium duty type, up to 200 strokes per minute—Full line of assessories.

For more information on these and other machines in the Big 4 line write for catalogs.



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WESTERN MACHINE TOOL WORKS

HOLLAND, MICHIGAN, U.S.A.

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VALVE CONTROLS
Barnes, John S. Corp., Rockford, Ill.
Logansport Mch. Co., Inc., Logansport, Ind.
Philadelphia Gear Works (Motorized), Erie Ave. and G St., Philadelphia, Pa.
Vickers, Inc., Detroit 32, Mich.

VALVES, Air
Bridgeport Brass Co., 30 Grand St., Bridgeport 2, Conn.
Hannifin Corp., 510 S. Wolf Rd., Des Plaines, Ill.
Hunt, C. B., & Son, Inc., 1911 E. Pershing St., Salem, Ohio
Hydraulic Press Mfg. Div., Mt. Gilead, Ohio
Logansport Mch. Co., Inc., Logansport, Ind.
Numatics, Inc., Milford, Mich.
Schrader's Son, A., 470 Vanderbilt Ave., Brooklyn 38, N. Y.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.
Tomkins-Johnson Co., 617 N. Mechanic St., Jackson, Mich.

VALVES, Hydraulic
Barnes, John S. Corp., Rockford, Ill.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio
Hunt, C. B., & Son, 1911 E. Pershing St., Salem, Ohio
Hydraulic Press Mfg. Div., Mount Gilead, Ohio
Logansport Machine, Inc., 810 Center Ave., Logansport, Ind.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Vickers Incorporated, Division of Sperry Rand Corp., 1402 Oakman Blvd., Detroit, Mich.

VERNIERS—See Calipers, Vernier; Gages, Vernier

VISES, Machine
Bridgeport Mches., Inc., 500 Lindley St., Bridgeport 6, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Modern Mch. Tool Co., 2005 Losey Ave., Jackson, Mich.
Producto Mch., Co., 990 Housatonic Ave., Bridgeport, Conn.
Universal Engineering Co., Frankenmuth 2, Mich.
Wesson Co., 1220 Woodward Hghts. Blvd., Detroit 20, Mich.

WELDING EQUIPMENT, Arc
General Electric Co., Schenectady, N. Y.
Lincoln Electric Co., 22801 St. Clair Ave., Cleveland, Ohio
Linde Air Products Co., New York 17, N. Y.

WELDING EQUIPMENT, Gas
Linde Air Products Co., New York 17, N. Y.

WELDING EQUIPMENT, Resistance
Eisler Engrg. Co., Inc., 750 South 13th St., Newark, N. J.
Federal Mch. & Welder Co., Warren, Ohio

WELDING POSITIONER
Eisler Engrg. Co., Inc., 750 South 13th St., Newark, N. J.

WELDMENTS
Bliss, E. W., Co., Canton, Ohio
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

WIPERS
Scott Paper Co., Chester, Pa.

WIRE
Allegheny Ludlum Steel Corp., Pittsburgh, Pa. (Stainless)
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., 105 W. Bern St., Reading, Pa.
Crucible Steel Co. of America, Henry W. Oliver Bldg., Mellon Square, Pittsburgh 22, Pa.
U. S. Steel Corp., (American Steel & Wire Co. Div., Columbia Steel Co. Div. Tennessee Coal, Iron & R. R. Co., Div.) 436 7th Ave., Pittsburgh, Pa.

WIRE FORMING MACHINES
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Eisler Engrg. Co., Inc., 750 South 13th St., Newark, N. J.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

WOODWORKING MACHINES
Atlas Press Co., Kalamazoo, Mich.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Greaves Mch. Tool Div., 2011 Eastern Ave., Cincinnati 2, Ohio
Greenlee Bros. & Co., 2136 - 12th St., Rockford, Ill.
Pope Mchry. Corp., Haverhill, Mass.

WRENCHES, Allen, End, Socket, Adjustable, etc.
Allen Mfg. Co., 133 Sheldon St., Hartford 2, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Chicago Pneumatic Tool Co., New York 17, N. Y.
Standard Pressed Steel Co., Jenkintown, Pa.
Williams, J. H., & Co., 400 Vulcan St., Buffalo 7, N. Y.

ZINC
New Jersey Zinc Co., 160 Front St., New York, N. Y.

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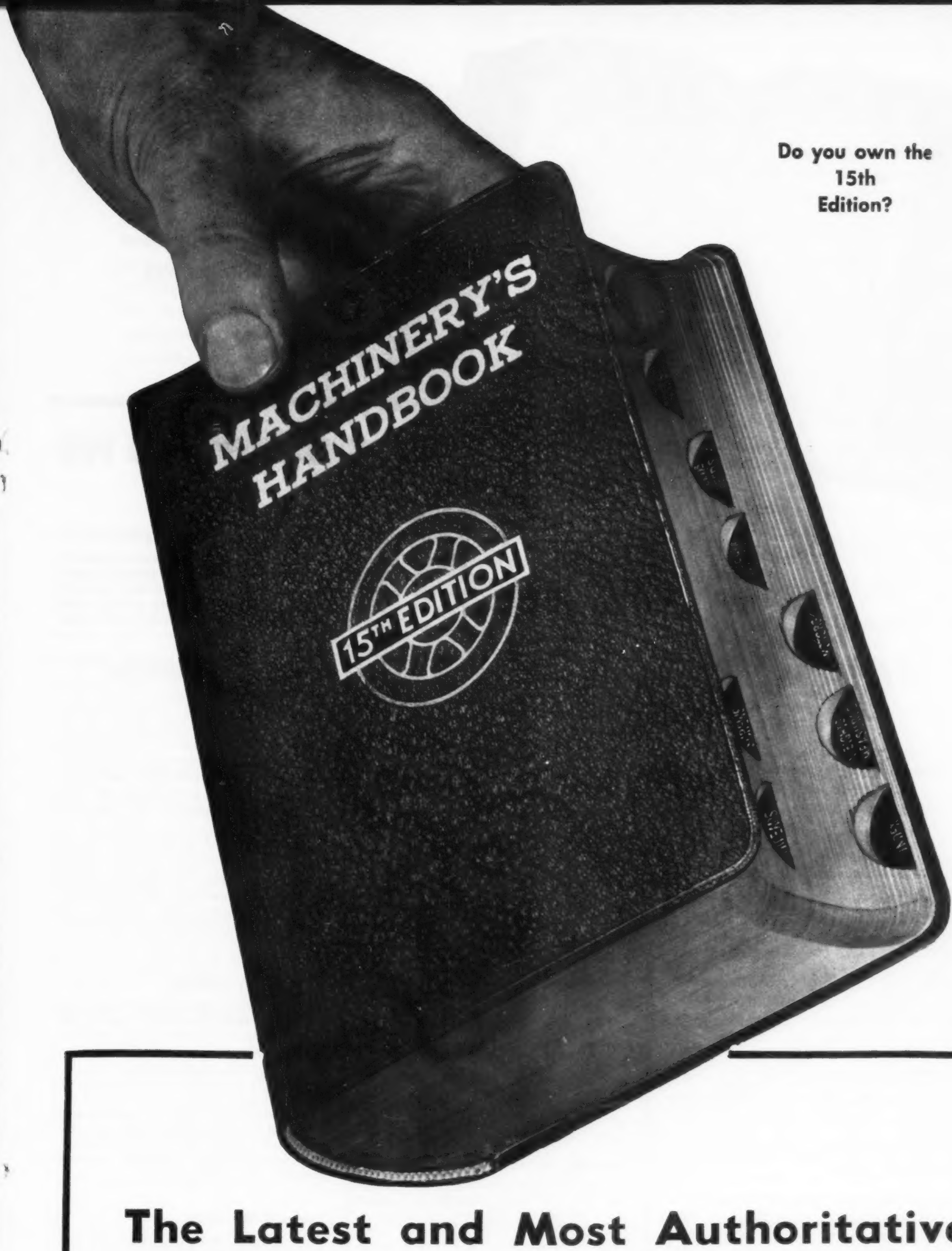

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Sizes, threads per inch and limiting dimensions of straight pipe threads for free-fitting mechanical joints for lock-nut connections; Dryseal internal threads (used without sealer); and internal threads in pipe couplings (used with sealer).

Standard Dryseal Taper Pipe Threads

Dimensions for crest and root modification of standard taper pipe threads for provision of metal-to-metal self-sealing joint.

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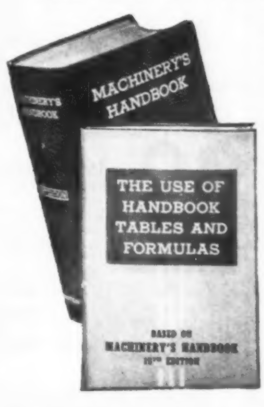

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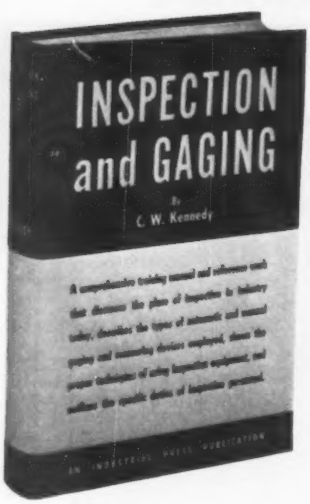

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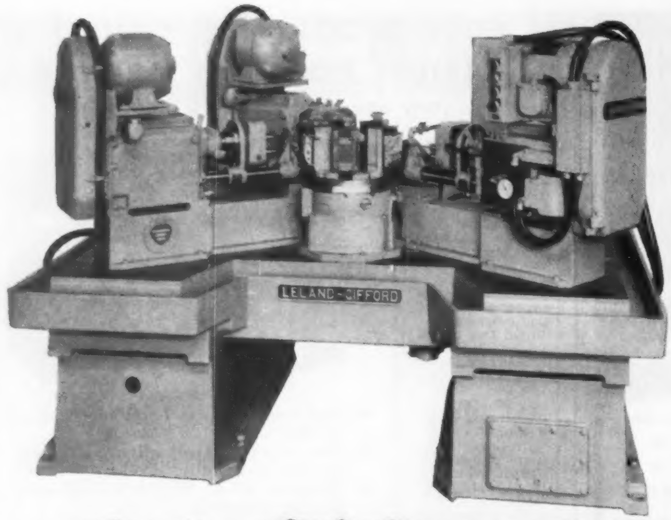

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THE SETUP — Three No. 2 self-contained deep hole units with 2-spindle multiple heads and a 5-station hydraulic indexing station. Production: up to 120 pieces per hour.

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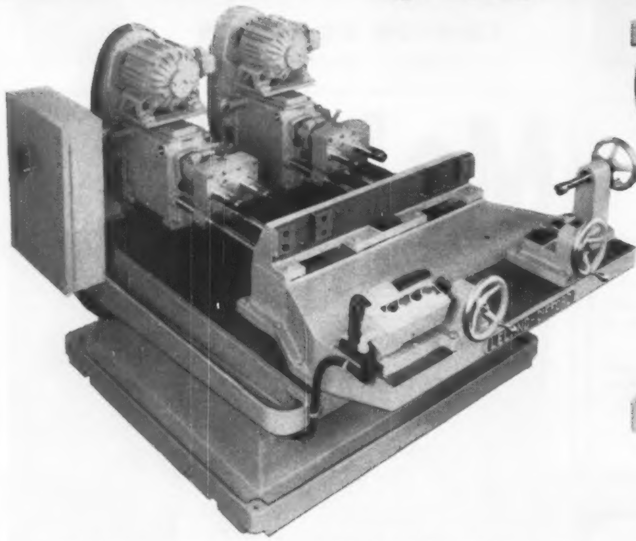

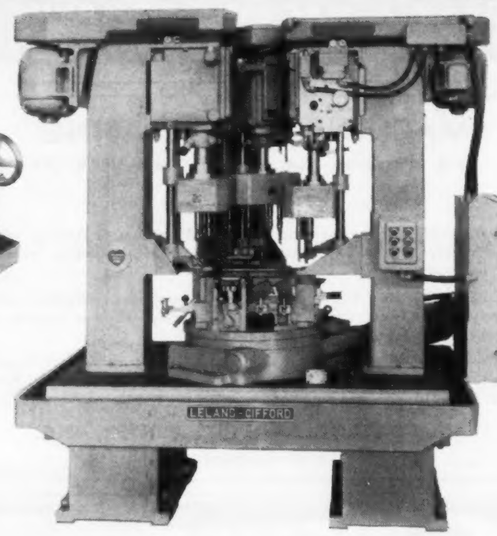

THE JOB — Drill and ream two .750/.751 dowel holes in 4 and 6-cylinder engine blocks.

THE SETUP — Two No. 3 self-contained units with 2-spindle heads mounted on a special base with work holding and positioning fixture.

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ALPHABETICAL INDEX OF ADVERTISERS

ALPHABETICAL INDEX OF ADVERTISERS

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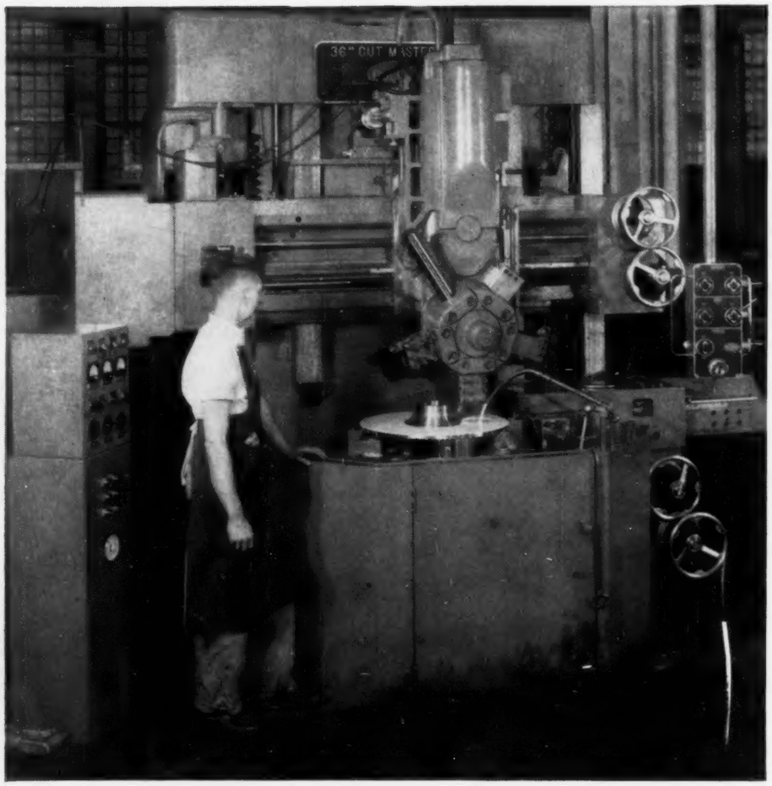
TIMKEN® bearing equipped . . . 1 lathe replaces 4, cuts machining time 81%



THIS new Bullard 36" Cut Master Vertical Turret Lathe, turning out hub discs and cover discs for turbo wheels at the York Corporation, York, Pa., has cut machining time an average of 81%. And does all the operations formerly done on 1 horizontal turret lathe, 2 engine lathes, and 1 older vertical turret lathe! Timken® tapered roller bearings play a major role in this production story.

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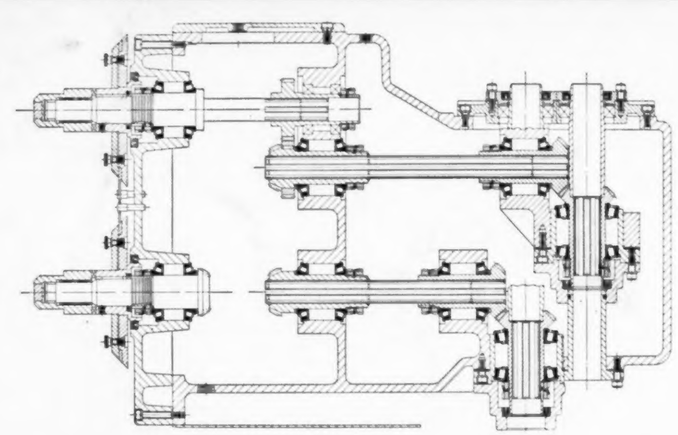
Look for the trade-mark "Timken" on each bearing! The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ont. Cable address: "TIMROSCO".

TIMKEN BEARING EQUIPPED *This symbol on a product means its bearings are the best.*



How **THE BULLARD COMPANY** mounts 16 Timken tapered roller bearings in the Hand Wheel Brackets of their vertical turret lathes.

TIMKEN *TAPERED ROLLER BEARINGS ROLL THE LOAD*

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